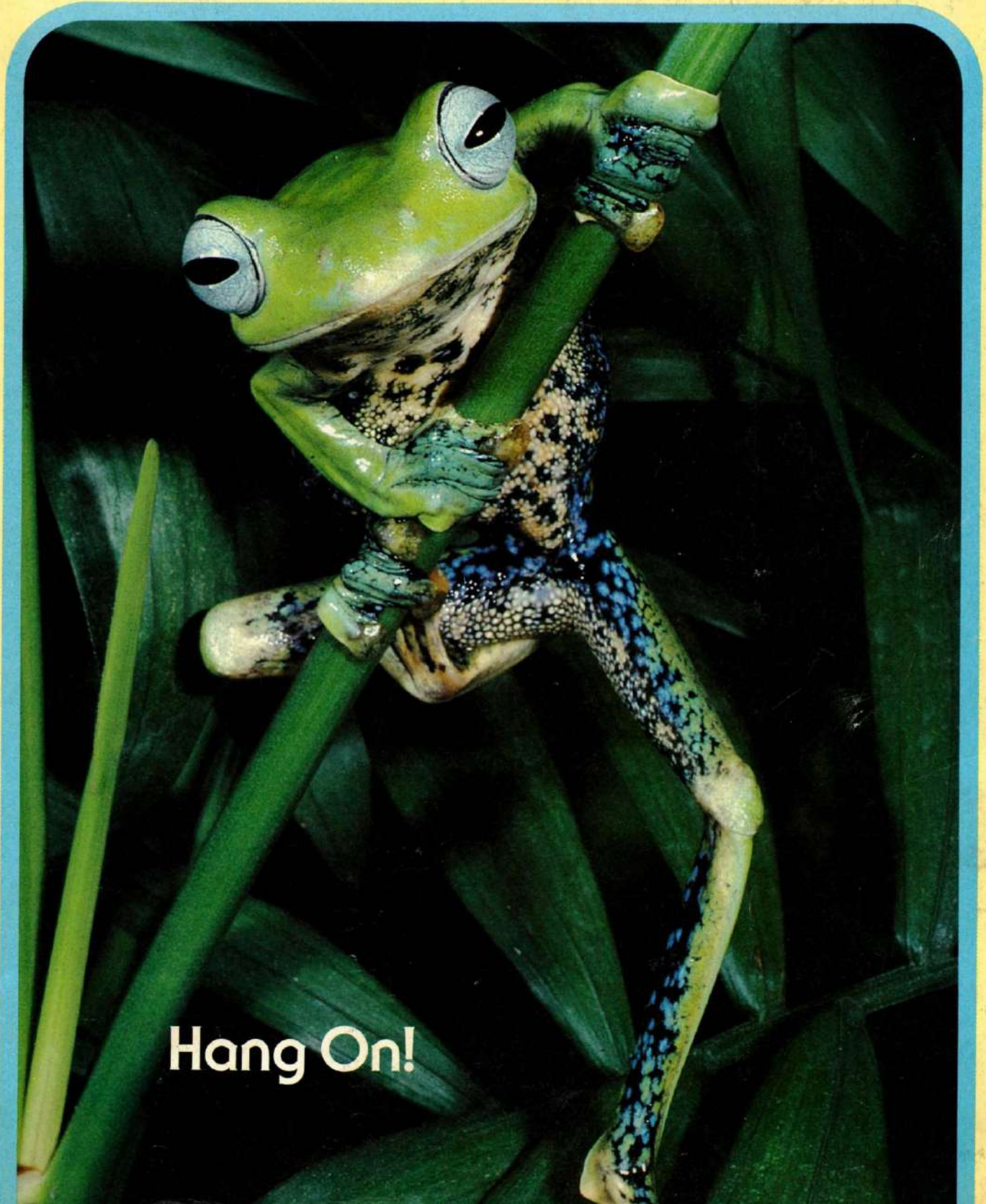
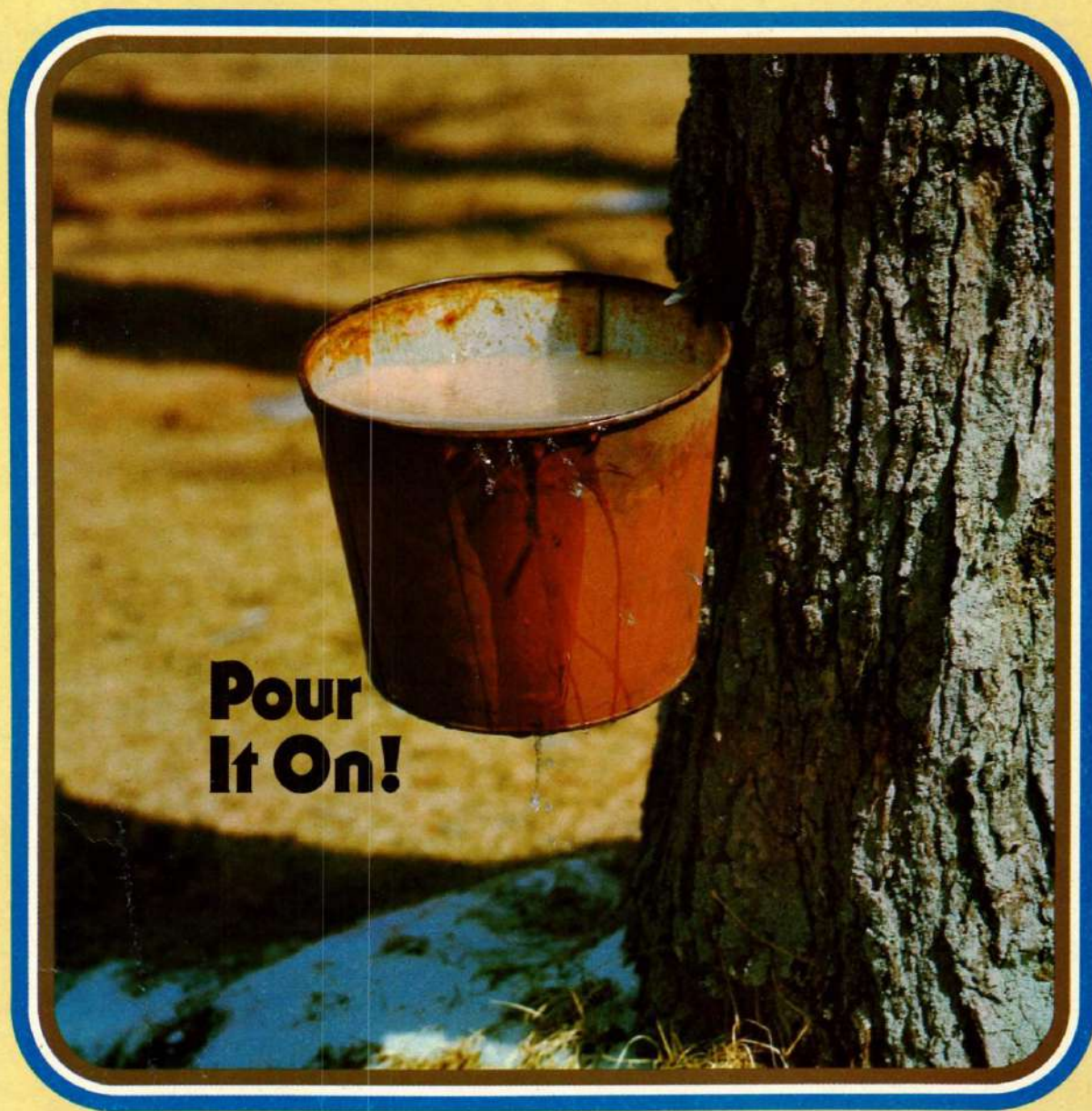


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Hang On!



**Pour
It On!**

Believe it or not, this bucket of liquid is the beginning of a delicious breakfast. It's the juice, or sap, of a maple tree. This sweet liquid is what maple syrup starts out as. But a lot goes on before it's ready to be poured over a stack of pancakes.

To find out how this gooey stuff goes from sap to syrup, turn to page 12.

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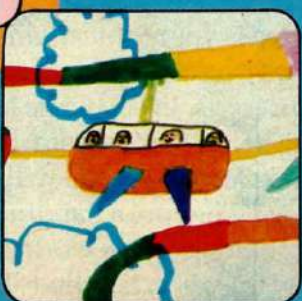
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CONTACT

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Cover photo: The Asian gliding frog can travel about 50 feet (15 m) through the air as it leaps from tree branch to tree branch.

Fantastic Frogs

by Sandra Markle



Ribbit. Ribbit. Sound familiar? It's just a couple of frogs reminding you that spring is here. Now that the weather is warmer, they are no longer hibernating in muddy ponds. Frogs are hopping into action again. And what you're likely to hear are the croaking noises they make to attract mates.

People are more likely to notice frogs right now. But there are always plenty around. You don't often see them, though. Frogs spend a lot of time in water, just as other *amphibians* (am-FIB-e-ans) do. In prehistoric times, amphibians were the first animals to come out of the water and live on land.

Today's frogs are much like their ancient ancestors. They live a double life. It begins in the water where frog eggs hatch into tadpoles. These wiggly little creatures have fins and a tail, just like fish. And also like fish, tadpoles breathe through gills. But soon tadpoles develop legs and lose their tails. They are growing into frogs.

As adults, frogs breathe through lungs. This gives them the ability to live on land and to search for food there. But frogs must never get too far from water. Sooner or later it will be time to lay eggs. When the eggs hatch, out will come tadpoles that

Above: These frogs are called—what else?—*red-eyed tree frogs*. They live in trees in the jungles of Central America. Notice the suction cup feet these frogs have. They are perfect for hanging around on branches.

once again need water to breathe and survive.

Their double life is what all frogs have in common. But there are big differences in the frog world, too. Some frogs are tiny, while others are huge. Some are brightly colored. Others are so dull that they blend in with their surroundings and are nearly impossible to see.

These differences make sense. Frogs have lived on earth for millions of years. In that time, they have adapted to many different living conditions. Not every frog is your typical run-of-the-pond variety. There are frogs living everywhere, from jungle tree tops to deserts. In each case, they are experts at surviving in the place where they live.

On the next few pages you will see a bunch of unusual frogs. They are a handful of the more than 3,000 kinds of frogs in the world. One look will tell you why this story is called "Fantastic Frogs."

Right: The *African clawed frog* looks a little like an overgrown tadpole. Unlike most frogs, it never leaves the water. This frog is unusual in another way—it has no tongue. But then it doesn't need one. Instead of grabbing insects out of the air, this frog uses its sharp claws to dig them out of the mud. Then it uses its legs to sweep them into its mouth.

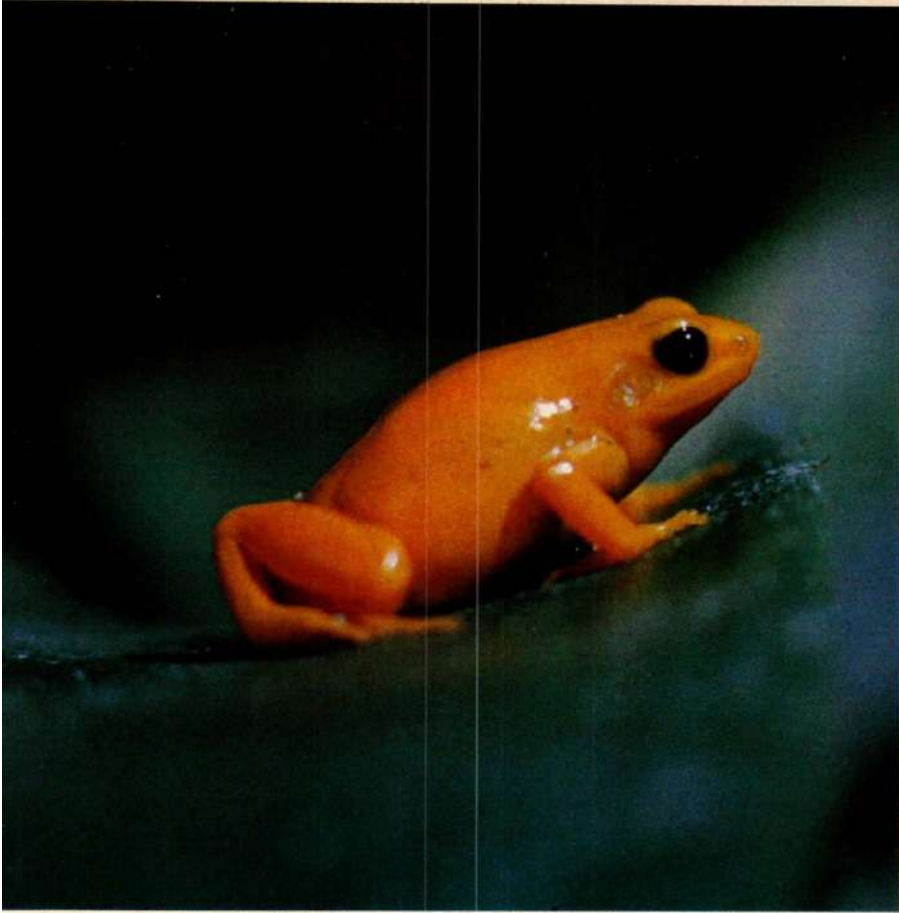


Below: What a nose! The *spatulate nose frog* has a large, flattened skull. It comes in handy whenever some other animal is after a frog dinner. The spatulate nose frog just pops into any small hole it can find. Then it plugs the opening with its head. This hopper has a built-in stopper!



Below: Not all frogs try to blend in with the background. For an *arrow poison frog*, it pays to be noticed. Glands in its skin give off a poisonous liquid. So its colorful skin is a message—stay away! How did this frog get its name? Indian hunters used to coat arrows with the frog's poison. ➡





Left: The *golden mantella* lives on a tropical island. It looks like a brightly colored arrow poison frog, but experts aren't sure that it is poisonous. Still, to many animals it looks poisonous. Its bright color is a way of saying, "Leave me alone. I don't taste good." In the case of the *golden mantella*, it pays to advertise!

Below: This *gray tree frog* looks like it has swallowed a ping-pong ball. Actually, it is filling its vocal sacs with air in order to croak. The frog's gray skin blends in with the bark of the tree that it lives on—the better to hide from hungry animals. Like some frogs, it can even change the color of its skin—lighter or darker—for a better match with its surroundings.





Above: This is no timid, shy frog. The *South American horned frog* believes that the best defense is a good offense. Grunting “Ah-ah-ah-ah,” it puffs up and leaps at its enemies. Even bigger animals are surprised enough to think twice about messing with this fellow!

Right: How is the *marsupial frog* like a kangaroo? Well, yeah, it hops. But there’s another way, too. That opening on the rear of its back is a kind of pouch. The frog carries her eggs in there for safe keeping. When it’s time to hatch them, she heads for water and turns her tadpoles loose.



Factoids

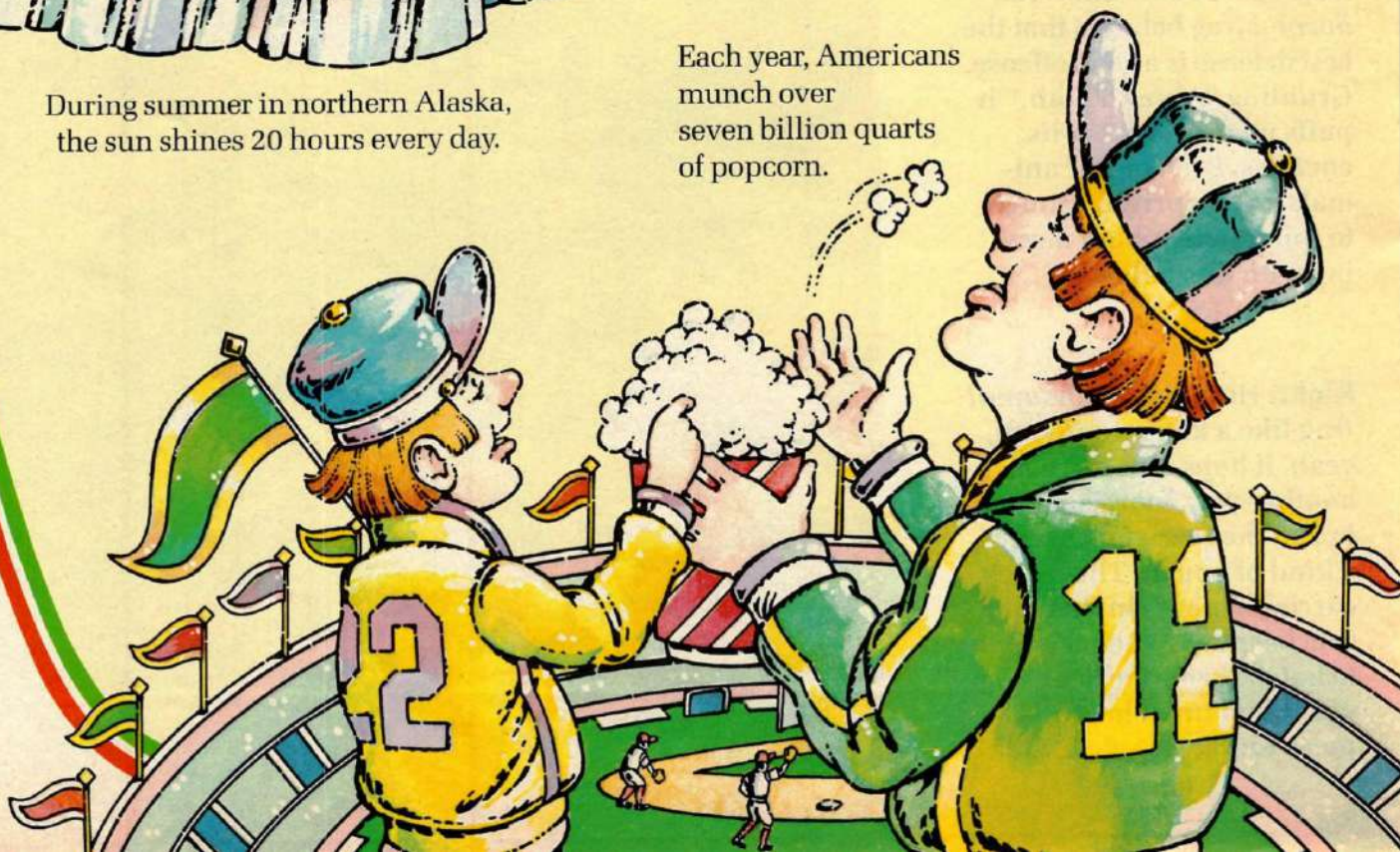


During summer in northern Alaska, the sun shines 20 hours every day.



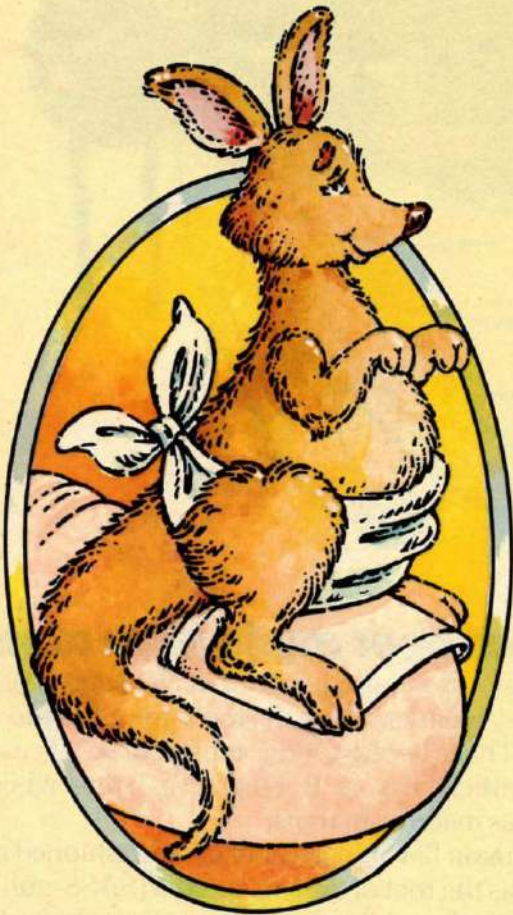
More salt is used for melting snow and ice in the U.S. than for anything else.

Each year, Americans munch over seven billion quarts of popcorn.





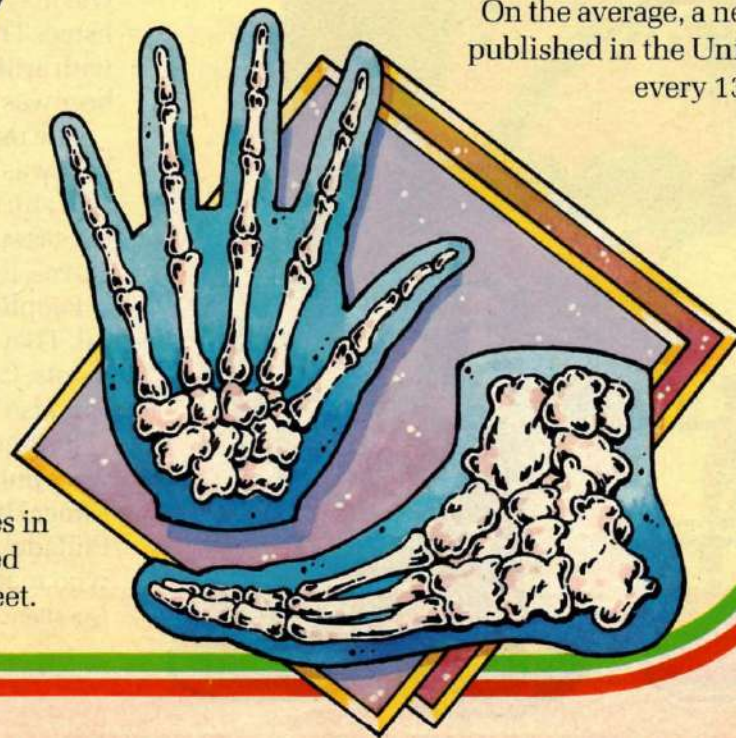
A honeybee may visit more than 1,000 flowers on one food-gathering trip.



A newborn kangaroo is small enough to fit on a person's thumbnail.



On the average, a new book is published in the United States every 13 minutes.



Nearly half the bones in your body are located in your hands and feet.

Any Questions?

by Susan Meyers

How do flies walk on the ceiling without falling?

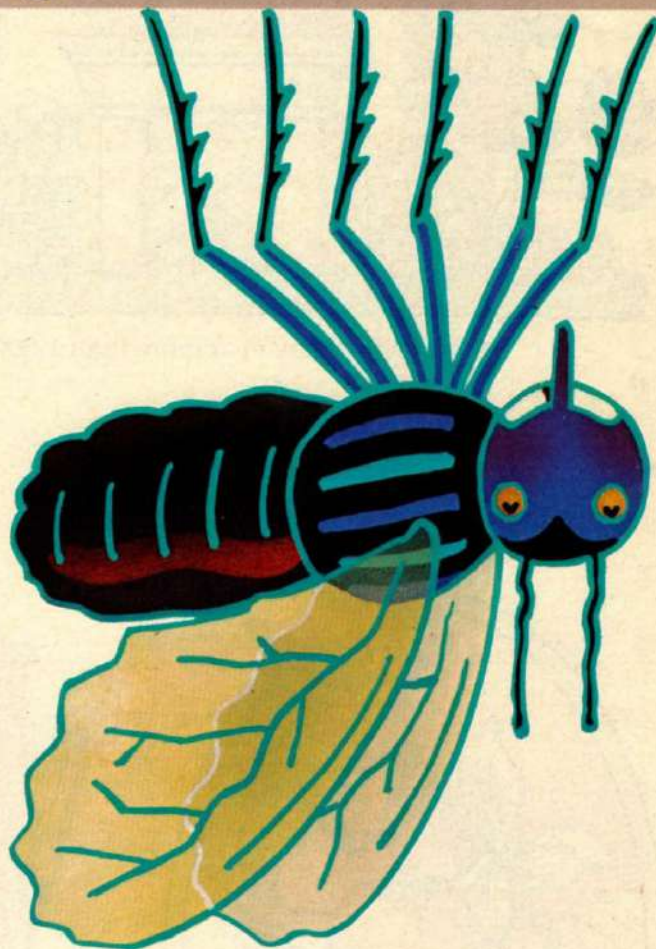
Have you ever wished you could stroll across the ceiling? Or walk up and down walls? Even if you had glue on the bottom of your feet, you couldn't. Unless, of course, you were a common housefly.

At the ends of a fly's legs are hairy little pads called *pulvilli* (pul-VILL-eye). The tiny hairs on these pads give off a sticky substance. The gluey stuff helps the fly stick to smooth surfaces, such as walls and ceilings.

Landing on the ceiling in the first place is quite a trick. First a fly buzzes along close to the ceiling. Then it reaches up with its front feet. When they touch the surface above, the fly flips its body over. And there it is, standing upside down.

Flies use their talented feet for finding food, as well as for walking on ceilings. Taste cells in the feet tell the fly when it has stepped onto something good to eat. Then it flicks out its tiny trunk-like mouth and quickly sucks up its dinner.

Question sent in by Tracy Utz, Linesville, PA.



Is root beer made from roots?

Read the list of ingredients on a can of root beer and you may wonder where the roots are. None are listed. That's because today most root beer is made with artificial flavors. But there was a time when root beer was made from roots.

The main flavor ingredient of old-fashioned root beer was the root of the sarsaparilla (SASS-puh-RILL-uh) plant. Mixed with flavor from the bark of the sassafras tree, wintergreen leaves, ginger and cloves, it gave root beer its special taste.

People thought that sarsaparilla was very healthful. They used it to treat coughs, colds and other ailments. Carbonated water, used to make soft drinks, was also considered an early day health drink.

It's not surprising, then, that these ingredients were put together by a medical student, Charles Elmer Hires. He began manufacturing root beer in Philadelphia in 1876. Nobody knows, however, who made the first root beer float!

Question sent in by Jay Kinghorn, Littleton, CO.



Do you have a question that no one seems able to answer? Why not ask us? Send your question, along with your name, address, and age, to:

Any Questions?
3-2-1 CONTACT
P.O. Box 599
Ridgefield, NJ 07657

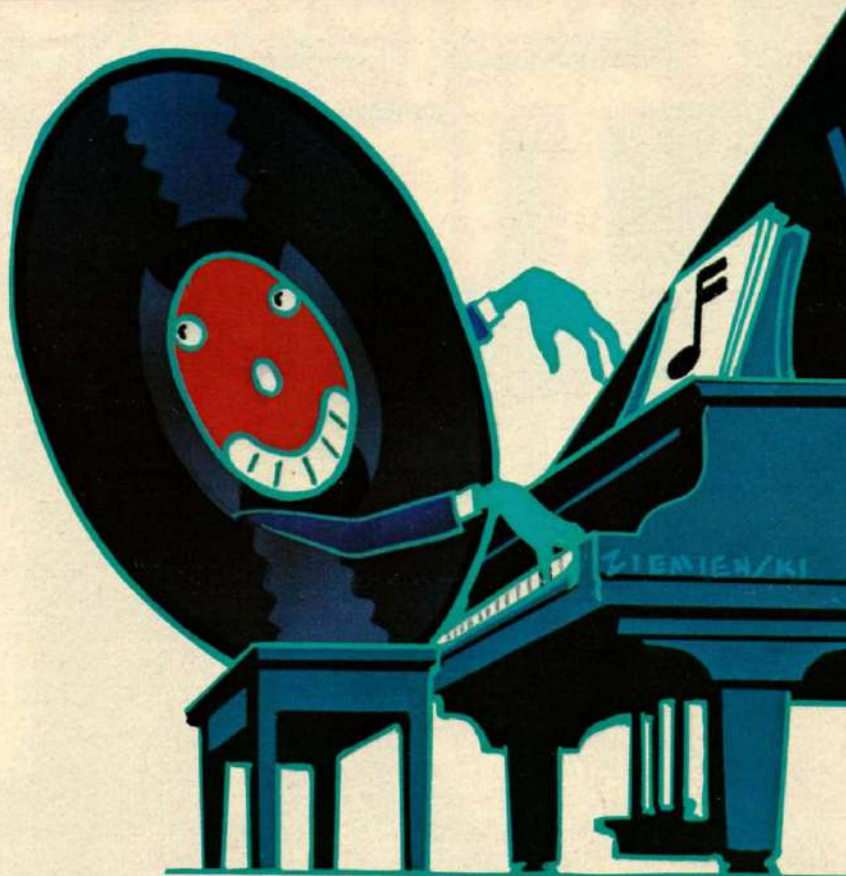
How do records make music?

The answer to that question is real groovy! Pull out two records from your collection. Look very closely at the pattern of grooves. Notice how they look slightly different. The grooves are a kind of musical code stamped on the disk at the factory. Every record has a different code. Luckily, you have a decoding machine—your record player.

Your phonograph needle is the first step in changing the tiny waves in the grooves back to music. The needle moves in the grooves and vibrates along the waves. The movements the needle makes are turned into electric signals. The electric signals move through the record player until they get to the speakers.

The speakers turn the electric current back into sound waves. Out comes the music, loud and clear.

Question sent in by Sara Nesbitt, Lacrosse, WI.



What is quicksand? You've probably heard of quicksand. Maybe you've seen movies in which people are sucked into a pool of quicksand and disappear. But what is quicksand really all about?

Quicksand is a mixture of plain old sand and water. It can be found at the mouths of rivers or along streams.

Quicksand forms when sand mixes with the water from rivers, streams or springs. The water surrounds each grain of sand. The sand, floating in the water, looks solid. But it's not.

If someone stepped into a pool of quicksand, and remained calm, he or she would probably not sink. Like any other pool of water, quicksand lets you float.

At the bottom of a pool of quicksand, there may be mud and solid rock. The rock keeps the water from draining out. Some pools of quicksand are shallow. Others are very deep. There's no way of telling how deep a pool of quicksand is unless you measure it—or step into it. But who wants to find out!

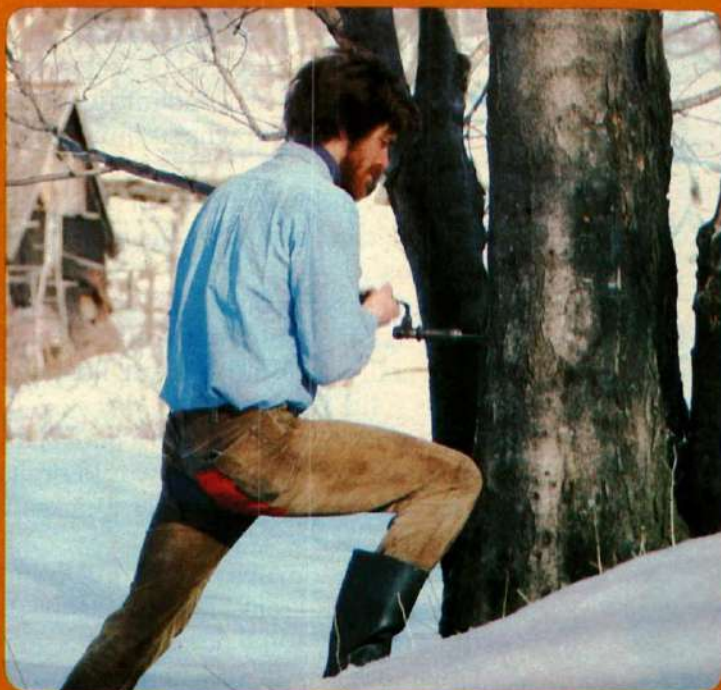
Question sent in by Keith Whinfield, Syracuse, NY.



Maple Syrup Time

MAKING A SWEET TREAT

by Anita Borgo



Maple syrup season is beginning just about now. As the days turn warm, snow begins to melt. Sap from maple trees will be collected in buckets.

Left: Before you can collect maple sap, you have to drill a hole in the tree. Then you put a tube into the hole. As sap flows out of the tube, it will be caught in buckets or plastic bags.

What's sweet as sugar, tastes great and comes from a tree? This sticky stuff is perfect for pouring over a stack of pancakes or a buttery waffle. What is it? Maple syrup, of course. And right now, it's maple-syrup-making season. People from Vermont to Wisconsin are taking buckets and buckets of sap from maple trees and turning them into syrup.

Maple syrup season begins in early spring. As the temperature rises above freezing, the ground around maple trees starts to thaw. The treetops get warmer, too. This creates pressure that draws the sap up from the roots. Sap travels up the tree trunk into the branches.

At night when the temperature drops, so does the sap. It flows back down to the roots of the tree. For about three weeks sap flows up and down the tree. This goes on until the weather gets really warm. Flowing sap helps a tree produce new buds and leaves. It's also the key to maple syrup making.

Exactly how does the sap from the maple tree get turned into syrup? If you would like to watch the old-fashioned way of making syrup, you could visit Coral Woods maple forest in Illinois. In fact, if you go there, you could even help make syrup.

A forest manager named Jim Grude is in charge. Around this time of year, he invites groups of school kids, as well as boy and girl scouts to the forest. There, he shows them how much fun it is to make maple syrup.

Tapping the Trees

First, Jim selects a sugar maple tree to tap. He measures each one. If a tree is ten inches around, he can put one hole, or tap, in it. If the tree is larger, he can add more taps. But Jim must be careful. Too many taps in a small tree could harm it.

Jim drills a hole into the tree so he can drain some sap. The hole must reach the sapwood layer of the tree trunk. "The sap travels through the sapwood as it rises from the roots to the branches," says Jim.

Next, Jim cleans the hole with bleach. The bleach kills bacteria that could grow there. If these germs were allowed to grow, they would close the hole. Then no sap could flow from it.

To channel the sap, Jim hammers a hollow metal tube into the hole. The tube has a hook on it. Jim hangs a bucket or a sturdy plastic bag from the hook. Now when the sap flows through the tree, some of it flows through the hollow metal tube into the bucket or bag.

Collecting the Sap

Maple sap is a combination of water, sugar, minerals and acids. If left in the sun too long, this mixture will sour. So Jim must collect sap reg-



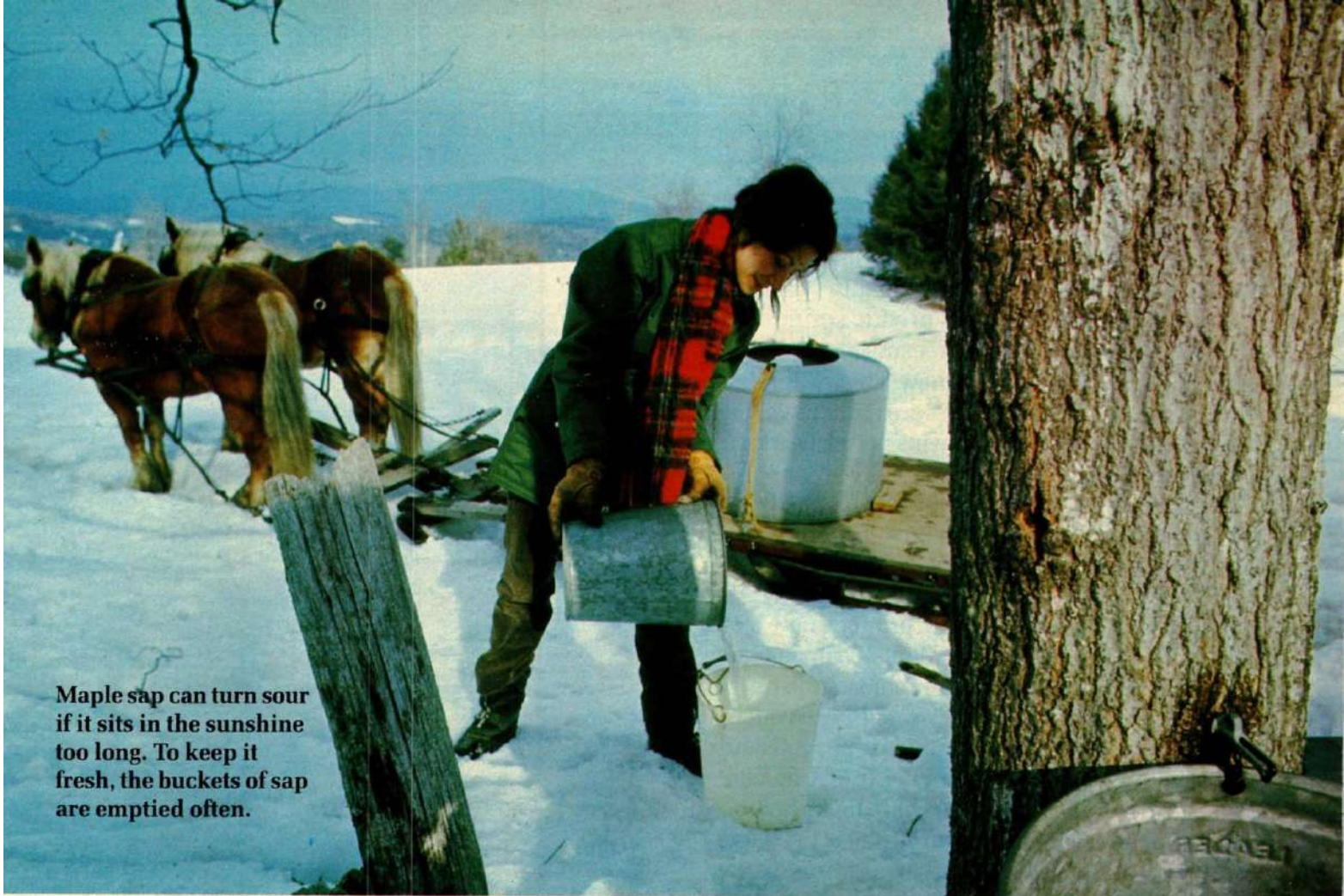
Above: Each spring, Jim Grude makes maple syrup the old-fashioned way. He is a forest manager at the Coral Woods maple forest in Illinois. Here, Jim shows these visitors the plastic bags that are sometimes used to collect sap.

ularly. On warm days he must do this every couple of hours. Often, kids who have come out to watch him work will help Jim with his collecting.

Each tap could produce up to five gallons (19 l) of sap a day. Jim says that some trees produce more sap than others. It all depends on the age of the tree and the kind of soil where it grows.

Three years ago, Jim first started tapping maple trees in Coral Woods. That's when this forest was bought by the McHenry County Conservation District where Jim works. Part of Jim's job ever since has been to show people how maple syrup used to be made long ago. The first year he tapped 10 to 15 trees. But he needed more sap to make more maple syrup. "So I used 25 to 30 trees," he says. "I had 50 taps going." This may seem like a lot of sap to you. But remember, it takes about 40 gallons (148 l) of sap to make one gallon (3.7 l) of syrup!

To turn sap into syrup, Jim boils it in an evaporator. This is a metal pan with a wood fire underneath. Slowly, water in the sap evaporates. Because sap is so full of water, hours pass before the sap becomes syrup. Frequently, foam appears on the ➡



Maple sap can turn sour if it sits in the sunshine too long. To keep it fresh, the buckets of sap are emptied often.

surface. Then Jim must skim it off. The sap seems to cook for hours without a change. Then suddenly it thickens and becomes syrup.

Once the syrup cools it will be bottled. A small sample will be given to everyone who comes to watch the syrup making. And the rest of the syrup? It is used up at a big pancake breakfast for all the people who work for McHenry County Conservation District.

The Indian Way

Maple syrup was first made long ago by the American Indians. Each spring, people from the Abenaki, Delaware and Ojibwa tribes traveled to maple sugar groves. There they boiled sap to make maple syrup and maple sugar. The sugar was made by boiling the sap longer than usual.

First, the Indians gashed trees with a tomahawk. Then they drained the sap through hollow twigs. Sap was collected in containers made from the bark of birch trees. For an evaporator, Indians used a hollow tree trunk. They poured the sap in, then boiled it by dropping hot stones inside.

Maple sugar later became very valuable on the frontier. It was traded to the settlers for other

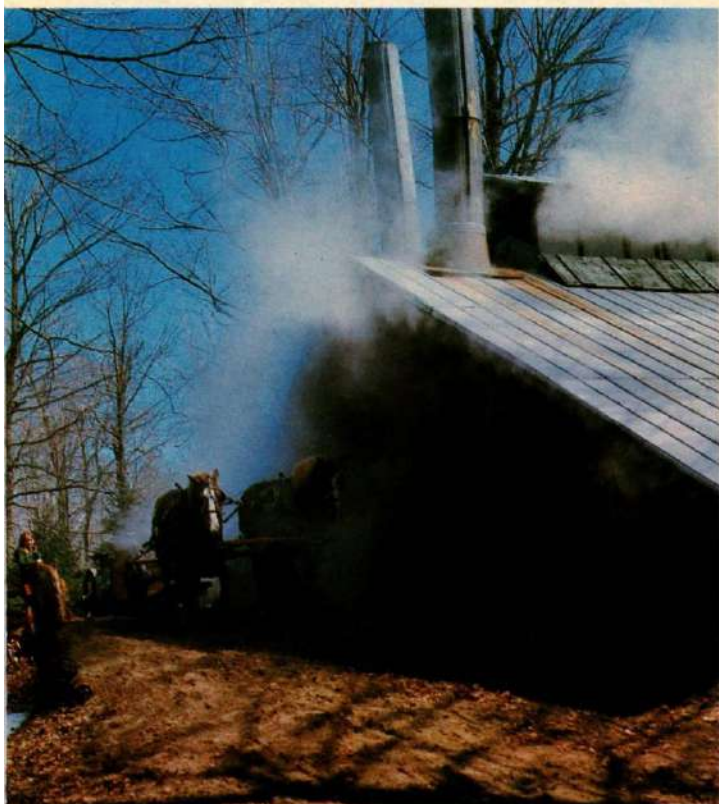
things the Indians wanted. Since it was stored in birchbark, it was called a "bark of sugar." The colonists soon discovered that maple sugar was tasty and began making their own. They improved on the Indian method by cooking the sap in large flat pans inside a building called a sugar shanty.

Maple Syrup Today

Today's maple syrup is made differently from the way the Indians did it. Even Jim Grude's method is considered a bit old-fashioned. Maple trees are hooked up to long lines of plastic tubing. Then a vacuum device drains the sap out. It travels through a pipeline to the sugarhouse. Here, sap is boiled over an oil or gas furnace instead of a wood fire. That means much more syrup can be made in a shorter time. "The amount I make in a day can be made commercially in about one third the time," admits Jim Grude.

But some people still tap sugar maple trees and make syrup the old-fashioned way like Jim does. For them, maple syrup time is three weeks of hard work. Why go to all that trouble? Jim Grude may have the answer. "Maple syrup season may be short," he says, "but it sure is sweet."

Right: This maple sap is finally getting turned into maple syrup. It is cooked in a large evaporator inside this modern processing plant. It will cook for hours. Then the sap will thicken into syrup.



Above: The building where maple sap is cooked is called a sugar shanty or sugar shack. Steam pours from the roof of this shanty while the cooking takes place.

Is It Maple Syrup?

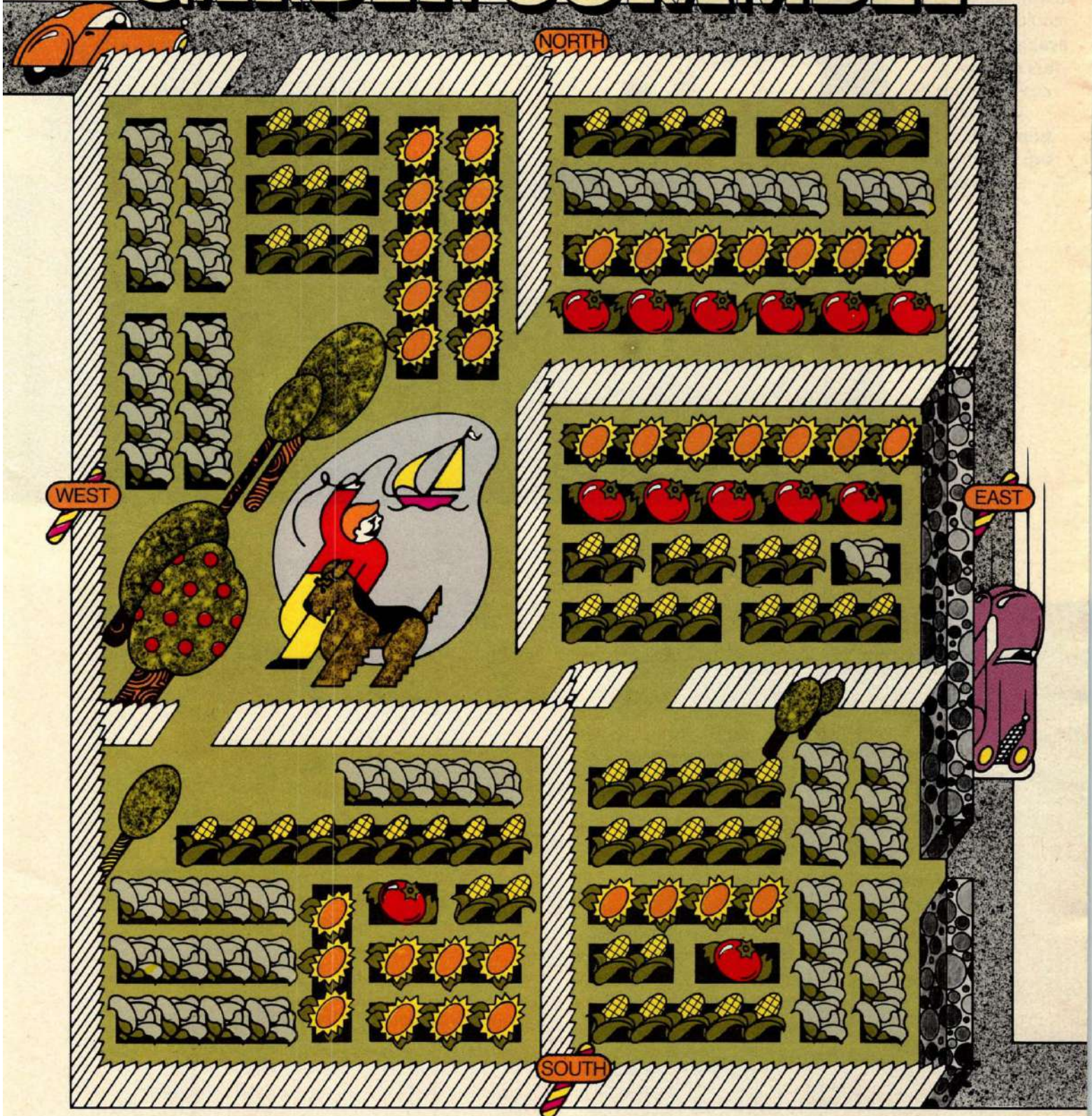
Next time you're pouring syrup over a stack of pancakes, take a closer look at the bottle's label. You may be eating real maple syrup. Then again, you may not.

Everyone agrees that maple syrup tastes great. But, as you read in the story, it takes a lot of sap to make a little syrup. So maple syrup is expensive.

Most bottled syrups are made from cheaper ingredients. They are called things like *table syrup* and *pancake syrup*. Instead of maple, their main ingredients are usually corn syrup or cane syrup.

To find out what's in your syrup, read the label on the bottle. The ingredients are listed in the order of amount. The most used ingredient is listed first. One thing you'll notice. Even cheaper kinds have maple syrup listed as one of the last things on the label. Cheap syrups have a dash of maple in them. Usually it's about 3 percent. It's added to improve the flavor. Maple syrup tastes so good that even a little bit goes a long way!

GARDEN SCRAMBLE



There are five gardens above. They are owned by five people—Joel, Susan, Marvin, Judy and Anita. Use the descriptions below to match the garden with its owner. Then write in the names.

● Marvin planted the least amount of cabbage in his garden.

● The garden south of Marvin's garden is owned by a girl.

● Two of the girls have gardens that can be entered from the street. The other girl does not.

● Marvin and Joel have planted more tomatoes in each of their gardens than any of the girls have in theirs.

● There is no water in Susan's garden.

● To get to Joel's garden from Susan's garden, you do not go through Marvin's garden.

● There is something growing in both Judy's and Susan's gardens that isn't growing in Anita's.

Answer on page 37.



Frog Bogglers

A CONTACT QUIZ

by Sandra Markle

Now that spring is here, everything is hopping. Birds, insects and especially frogs. Boy, can they hop! There is one kind of frog that can jump 10 feet (3 m) in a single leap. Frogs can do some other surprising things, too. Want to know more fascinating facts about frogs? Then take this quiz. Come on now, hop to it!

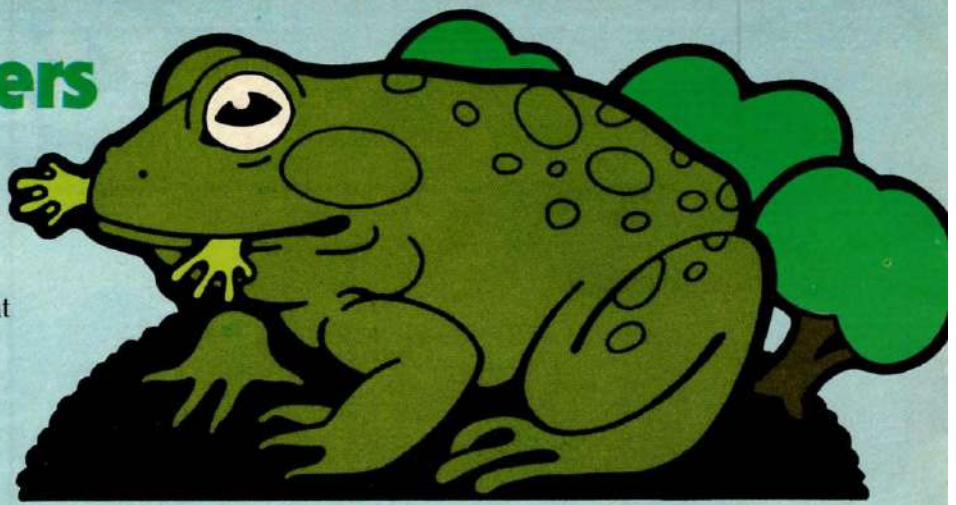
- 1.** One kind of frog is as big as a chicken.
True or False?
- 2.** The bigger the tadpole, the bigger the frog will be.
True or False?
- 3.** Frogs always blink when they swallow food.
True or False?
- 4.** Some frogs can fly.
True or False?
- 5.** Big frogs jump farther than little frogs.
True or False?
- 6.** Frogs croak only at night.
True or False?
- 7.** Frogs and toads are the same.
True or False?
- 8.** Frogs always hop away from their enemies.
True or False?

Answers on next page.

Quiz Answers

1

True Most frogs are small. But the goliath frog of Africa is a real whopper. Goliath frogs weigh about seven pounds (3 kg). Goliaths also measure over a foot (.3 m) long. These big frogs eat practically anything they can capture. That includes mice, scorpions, insects and even—gulp!—smaller frogs. You might think this jolly green giant would have a loud voice. But goliath frogs can't make a single croak. That doesn't matter, though. When you're the biggest, you don't have to make noise to get noticed.



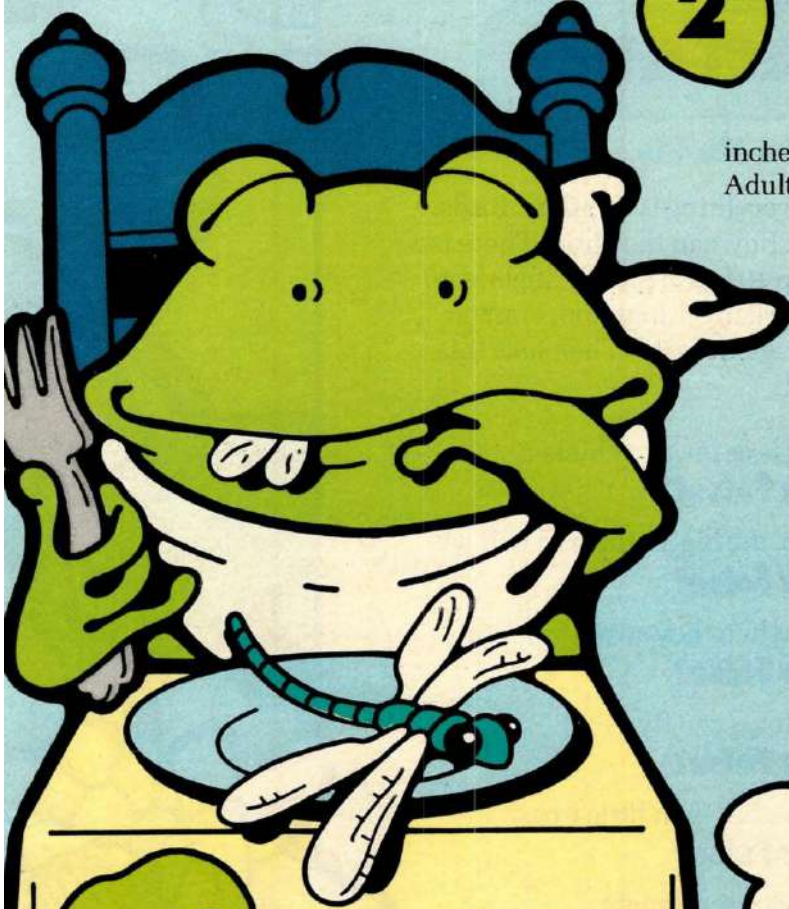
2

False When tadpoles become frogs, they usually look like what you would expect. Little tadpoles become little frogs. And big ones turn into big frogs. But there's at least one group of frogs which ignores this rule completely. In South America, the tadpoles of the *paradoxical frog* are about 13 inches (33 cm) long. But they *shrink* as they change into grownups. Adult paradoxical frogs measure only one and a half inches (3.8 cm). These frogs don't grow up, they grow down!



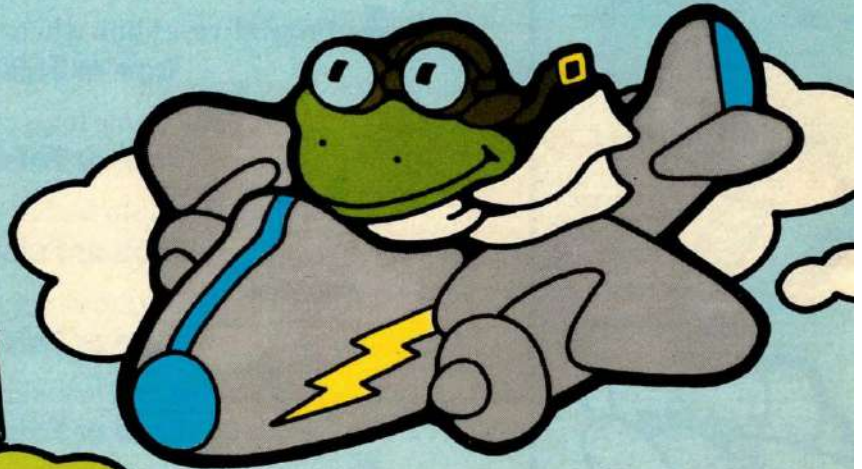
3

True Strange as it may seem, blinking its eyes helps a frog to eat. Frogs don't chew their food. So they need to swallow in one big gulp. When a frog blinks, it draws its eyeballs down onto the roof of its mouth. That makes a bulge which squeezes the food down the frog's throat. And what if the food is really hard to swallow? More help is on the way. A frog will simply use its front feet to cram in the food. Not good manners in the human world—but fine for a frog.



4

False Frogs fly? Of course not. Still, don't be surprised if you someday see a frog soaring overhead. In some parts of the world there are gliding frogs. They float through the air, leaping from one tree branch to another. These frogs have huge feet with webbed toes. They also have extra flaps of skin at their elbows and knees. All this extra skin works like a built-in parachute. What would Kermit have to say about all this? Geronimo!

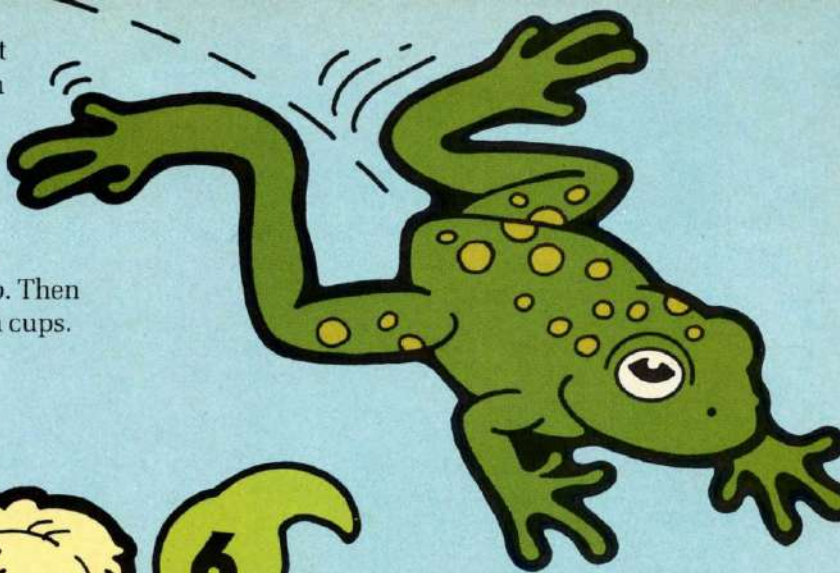


5

True Big frogs are usually big jumpers, just as you might expect. For example, a goliath frog can jump ten feet (3 m) in one leap.

That is about 10 times its own length. But one little frog is also a champion jumper for its size.

The arum frog is only one inch (2.5 cm) long, but it can jump 24 times its length. The arum frog also knows a few other tricks. It can jump 18 inches (45 cm) straight up. Then it hangs upside down from a leaf, using its toes as suction cups.



6

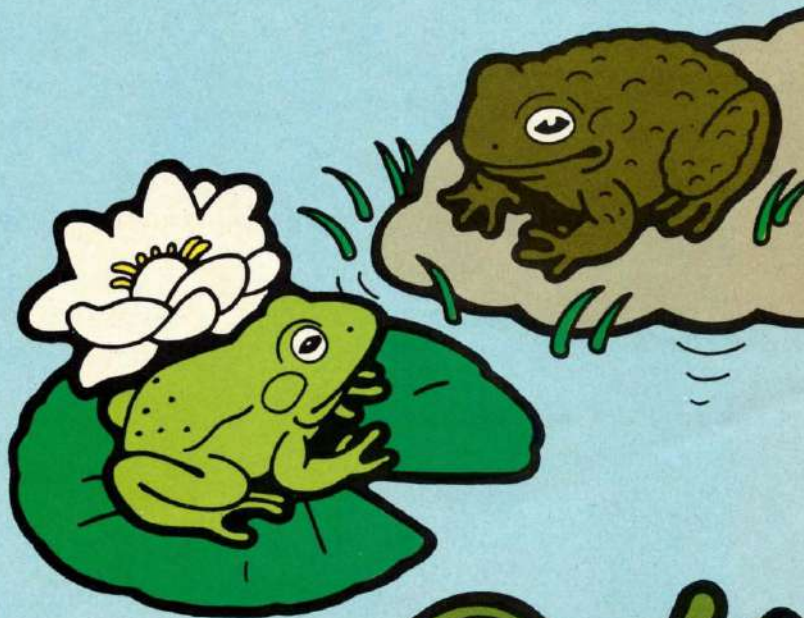
False Ribbit. Ribbit. That's what you may hear night after night this time of year, especially if you live near water. But there are frogs that tune up in the daylight hours as well. Frogs can make a lot of noise. But whether the froggy chorus begins at noon or night, the purpose is nearly always the same. It's romance. Male frogs croak because they're looking for mates.



7

False Yup, frogs and toads do look a lot alike. They both hop on long hind legs.

They both have big bulgy eyes. But there are many differences, too. Frogs spend most of their time in or near water. Their skin is smooth, thin and moist. Toads, on the other hand, live in dry places. Many go into water only to lay their eggs. Toads have skin that is more dark and dry. Here's another difference to remember if you try to catch a frog or toad. Those lumps on a toad's skin contain an irritating liquid. The liquid won't really hurt you, but it might make your skin itch. So if you touch a toad, wash your hands.



8

False Frogs sure hop to get out of trouble. But sometimes they hop straight at an enemy. This can startle a foe and help a hopper to get away. Frogs can leap straight forward or make zig-zag hops. They will go any direction except backward. Using their powerful hind legs, frogs push against the earth and launch themselves into the air. When they come down, they may have traveled 20 times their own length. If you could jump that far, you'd go about 80 feet (24 m)!





Flea
1 foot (.3 m)



Grasshopper
5 feet (1.5 m)



Jerboa
10 feet (3 m)



Jumping Mouse
10 feet (3 m)



Galago (Bush Baby)
15 feet (4.6 m)

Tops in Hops

Frogs aren't the only animals that are terrific jumpers.

Here you'll find some other animal jumping champs and the distances they can travel in one leap.*



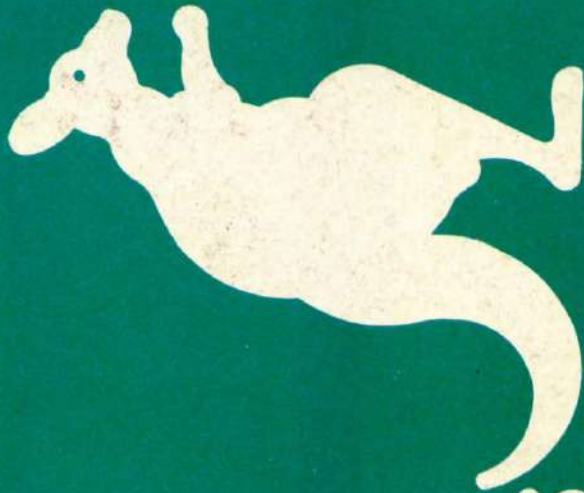
Frog
18 feet (5.5 m)



Jackrabbit
20 feet (6 m)



Human
29 feet (8.8 m)



Red Kangaroo
42 feet (12.8 m)



Snow Leopard
49 feet (14.9 m)

*All distances are estimated to the nearest foot.

Contact Report

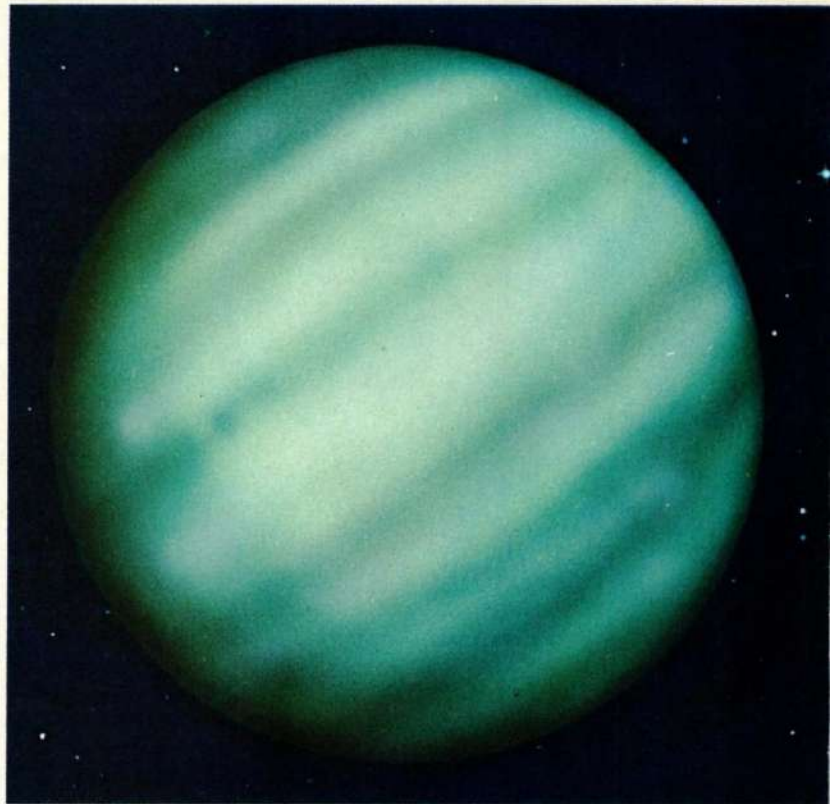
by Rebecca Herman

Ring Around a Planet? Last year, astronomer Edward Guinan announced that Neptune may have a ring—just like Saturn, Jupiter and Uranus.

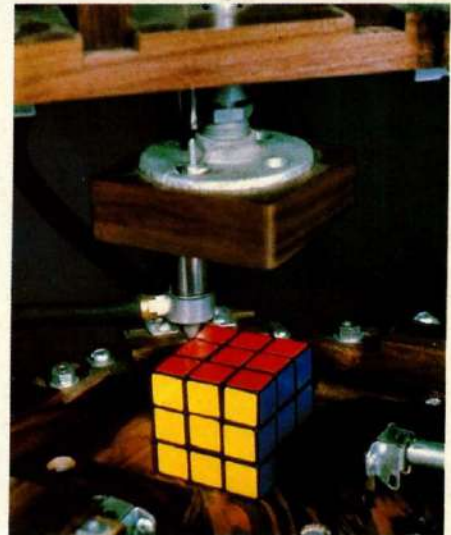
Actually, Edward's news is not so new. He did his research 15 years ago, but didn't realize what he had found. In 1968, Edward wanted to learn about Neptune's atmosphere. So he went to New Zealand. That was the only place he could watch the planet as it passed in front of a certain star.

On his way home, some of Edward's charts and papers were lost. He didn't get around to looking at the rest until recently. He found that even after Neptune had passed in front of the bright star, the star's light stayed dim. Maybe what blocked that light was a ring around Neptune, Edward decided.

He won't know for sure until 1989, however. That's when the spacecraft *Voyager 2* will visit Neptune and take pictures.



Neptune may turn out to have rings around it.



Robbie Rubik What's made of old junk, has electric flippers and can solve Rubik's cube in six minutes? It's a new robot, called Robbie Rubik.

Robbie was built by some students for a science contest at the University of Illinois. They used scrap wood, some pieces of plumbing and even an old elevator motor. Robbie's most important part, however, is a microcomputer. The computer is what helps the robot to solve the puzzle.

The students programmed the computer with instructions from a cube-solving book. To get Robbie started, they tell the robot what the pattern of the little squares is. Then the computer needs less than one second to figure out its strategy. But by the time the clunky robot flips all the squares into place, more than six minutes go by. *Information for this Contact Report was sent in by Lisa Stringer, Clarksburg, MD.*

Contact Report

See You Later, Alligator When biologists Mark Fergusen and Ted Joanen studied alligators in the Louisiana swamps, they discovered something pretty surprising. And what they learned from these modern reptiles may offer a clue about how their dinosaur relatives became extinct long ago.

Ted and Mark found that the temperature of an alligator egg before it hatches determines whether the little alligator will be male or female. If an egg is kept warm at 94°F (34°C), it hatches a male. A cooler egg—kept at 86°F (30°C)—produces a female. Any eggs hatched at temperatures in between will develop some males and some females.

Suppose the same thing were true for dinosaurs long ago. After a spell of very hot weather or extremely cold temperatures, the next crop of baby dinosaurs might have been all females or all males. That would have stopped the dinosaurs from reproducing.

Ted and Mark have a good theory. But no one yet knows for sure why dinosaurs disappeared from the earth.



Can alligators help explain why dinosaurs vanished?

Shhhh Too much noise can hurt your ears or make you jumpy. But what does loud noise do to animals? It may make them feel jumpy, too.

A few years ago, the Environmental Protection Agency (EPA) began studying how animals react to noise. Among the animals the EPA watched were grizzly bears. When grizzlies hear the roar of a jet plane, for example, they get scared. They stop whatever they're doing and run away. If loud noises happen a lot, the bears may change the way they look for food and how far they travel.

The EPA says that many animals can be hurt by loud noises. And since an animal can't protect itself with earplugs, it's up to people to keep things more quiet.

What's That? Have you read about a kid who invented something new? Or one who set a new science record? Then cut out the story and send it to us. If we use it, you'll get a CONTACT T-shirt. Include your name, address, T-shirt size and the name of the publication the story came from.

Write to: **The Contact Report**
P.O. Box 599
Ridgefield, NJ 07657



Too much noise upsets grizzly bears and other animals.

The Mystery of Memory

by Joan Graf



Your short-term memory keeps a fact in your mind for only about 30 seconds. If a telephone line is busy, you'll probably forget the number and have to look it up again.

Sometimes you forget the things you most want to remember.



What do you have that you use every day but can't see, touch, taste or smell? Without this thing you couldn't tell a joke or play baseball or even describe what you had for dinner last night. What makes all these activities possible? Your memory. Your ability to remember things shapes the world around you.

Important as your memory is, you don't have perfect control over it. Sometimes you forget things you most want to remember. Like those facts you studied that seem to vanish when you take a test. And sometimes you're bugged by remembering something you would rather forget, like a dumb jingle from a TV commercial.

Would you like to learn how to use your memory better? So would a lot of other people. In fact, scientists are also quite interested in memory. They study it by giving people tests. Slowly they are

learning more about how human memory works.

Different Kinds of Memory

One theory that researchers have come up with is that you actually have several kinds of memory. The first kind is *short-term memory*. Using this form of memory, you can recall little bits of information for 30 seconds or less. For example, you can usually remember a new telephone number long enough to dial it. But what if the line is busy? You'll probably forget the number and have to look it up again.

Fortunately, there is a way to hang on to information you would like to keep. All you have to do is rehearse it. Repeat it again and again. That helps you to place information in a more permanent home in your mind. That is *long-term memory*. It seems that your brain can store practically unlimited amounts



of information in long-term memory. But the tricky part is figuring out how to recall this information when you need it.

One fact about your memory seems clear, however. When things happen that cause strong feelings, you're more likely to remember them. You will probably recall an embarrassing moment, like forgetting your lines in a school play, much more clearly than what you talked about at dinner last night. The embarrassing moment is an example of what is called *flashbulb* memory. Most people have a handful of those especially clear memories.

What causes these events to stand out in your mind? No one knows for sure. But scientists think your brain may release a certain chemical when you're surprised or upset. This chemical seems to say, "Pay attention and remember this!"

Forget It!

You forget lots of things. Actually, that's not all bad. It might be boring to remember all the tiny details of every single thing you have ever seen and heard. Then, too, there are bad memories of breaking your arm that you are glad to forget. Some researchers think that your brain forgets some of these unpleasant things on purpose. That makes sense.

But sometimes forgetting is just the opposite of what you want to do. Why do you forget the punch line of a joke you want to tell to a friend? The answer seems to be that if you don't organize and store information well in the brain, you'll have a hard time recalling it when you want it. That is like trying to find a particular number in a phone book that lists names in no special order.

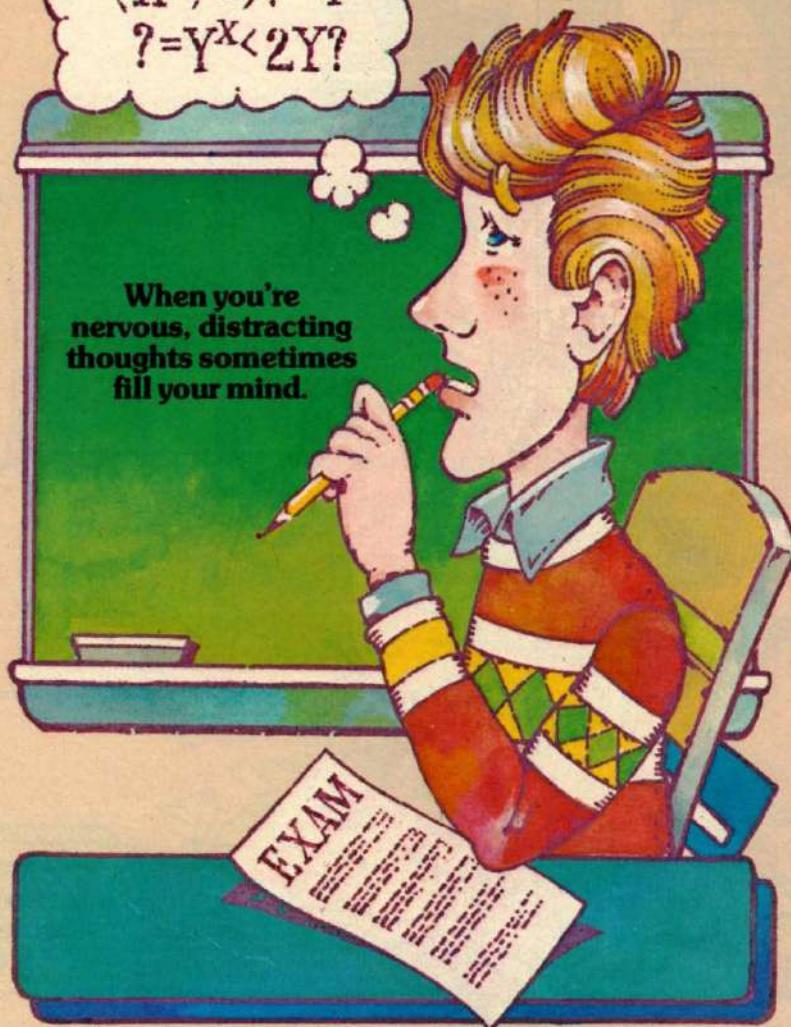
Sometimes it is not just a bad job of organizing

When events cause strong feelings, you're more likely to remember them.



$$\begin{aligned} X^2 + 2(X-?) \\ (Yr^2) \geq ? + 4 \\ ? = Y^X < 2Y? \end{aligned}$$

When you're nervous, distracting thoughts sometimes fill your mind.



your memories that gets you in trouble. Does your mind ever go blank during a test? Here's why that happens to a lot of people. If you're very nervous, distracting thoughts may fill your mind. They can interfere with finding the memory you want to locate. It's like trying to read while loud music is pounding in your ear.

Some memory problems are more serious. In rare cases, a person may even forget who he or she is. This kind of forgetting is called *amnesia*. It is very unusual. It happens more often in books and on television than it does in real life. There is a more simple kind of amnesia, as well. Sometimes, a kid gets an accidental knock on the head. Then he may wake up and discover that he doesn't remember what happened for hours or even days before the accident. But the rest of his memory will work as well as ever.

Are there any keys that people can use to unlock

their hidden memories? Hypnosis was once considered such a key. The police sometimes hypnotize witnesses of crimes to help them recall what a robber looked like. Sometimes it really works well. But at times hypnosis just seems to work. Hypnotized people will occasionally invent things they think the hypnotist wants to hear—without knowing they are making things up.

For example, a researcher showed students a movie of a car accident. One student was then hypnotized and asked about the car's license plate. He said it was a California plate which began with a V or W. That seems very impressive. But the car didn't have a license plate at all. It may be a mistake for police to count on information from a hypnotized witness. They might arrest the wrong person!

Memory Tricks

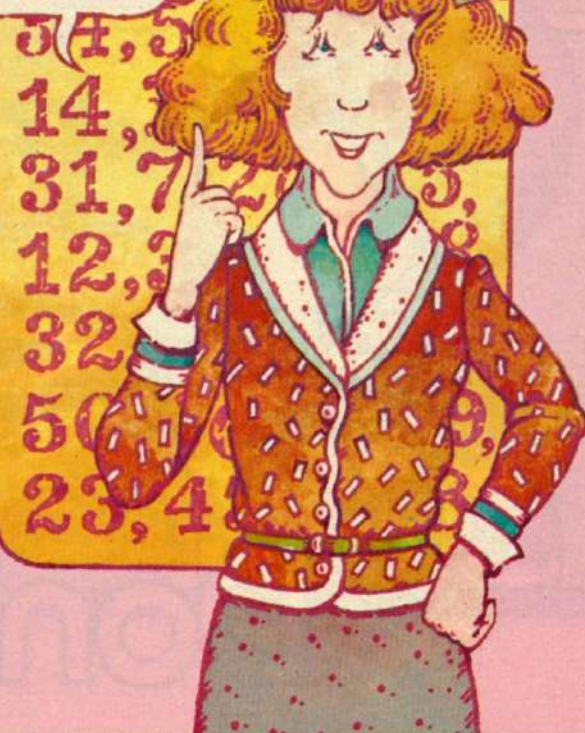
Do some people have minds like cameras that

People who get an accidental knock on the head may wake up and discover they don't remember what happened for hours before the accident.



A few rare people can look at 50 numbers for a few minutes, then repeat them exactly, years later.

14, 25, 11, 45, 11, 28,
43, 6, 31, 7,
28, 12, ...



produce memories clear as photographs? That's what is called a photographic memory. Most researchers don't believe in the idea of a photographic memory. They admit, however, that a few rare people can look at 50 numbers for a few minutes, then repeat them exactly, months or even years later.

But most people with remarkable memories have actually learned memory tricks, instead. You can learn to use these tricks, too. They work by linking hard-to-remember information to catchy rhymes and silly mental pictures.

Here are a few examples of useful memory tricks:

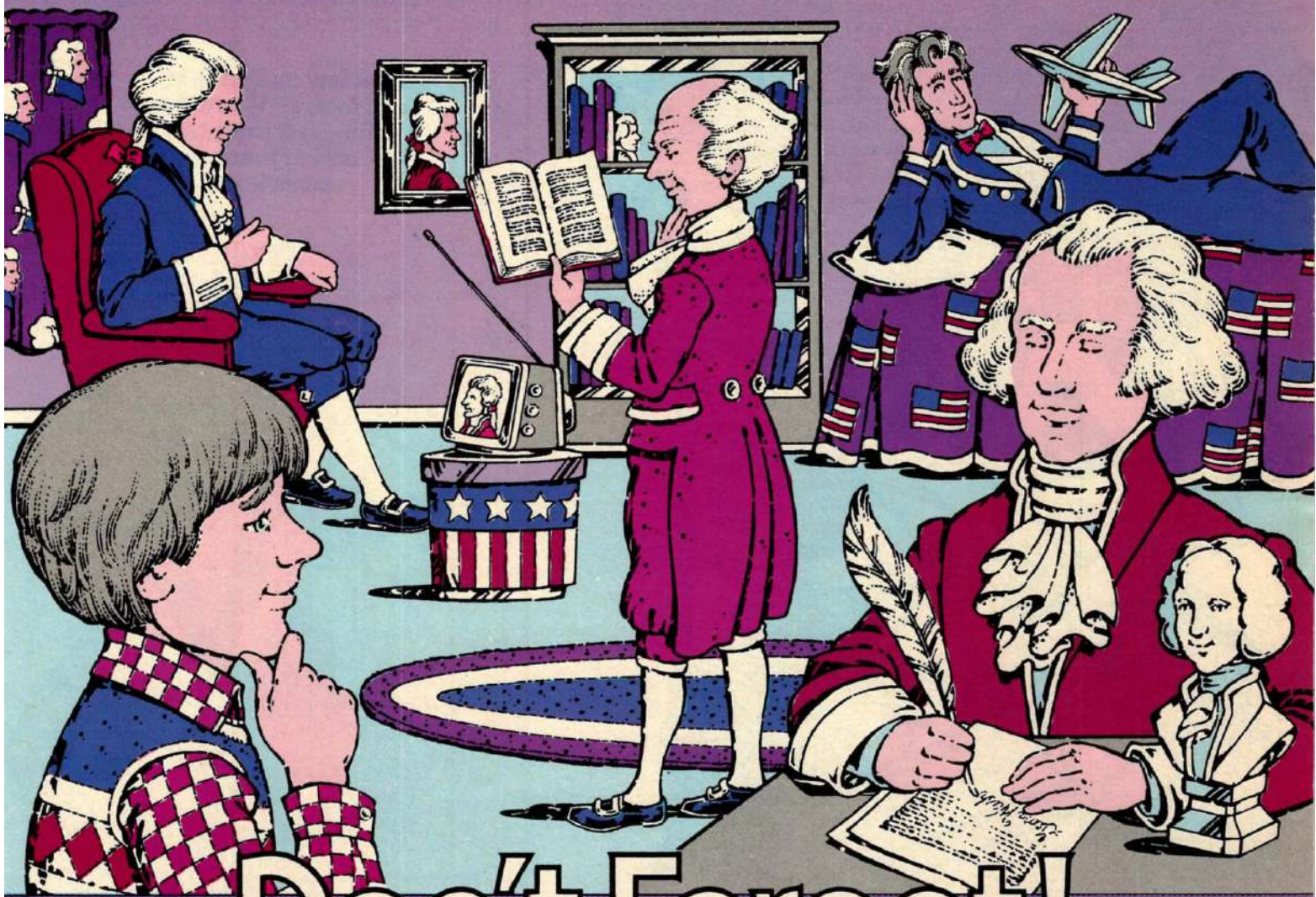
- Rhymes are easy ways to remember facts. Do you know why vitamin A is important for your health? A rhyme that once appeared on a Cheerios box might remind you. It said:

"The vitamin A has important connections.
It aids in our vision and helps stop infections."

- Here is a trick for remembering lists of words. Take the first letter of each word on the list and make a new word, using these letters. Can you name the five Great Lakes? Some people remember Huron, Ontario, Michigan, Erie and Superior by putting together the first letters of each lake to spell HOMES.

- You can also make a simple sentence out of a list of letters. Take the letter names for each line of music in the treble clef. They're easy to remember with the sentence, "Every Good Boy Does Fine."

These are good shortcuts to help you remember certain facts. But using them is not the magic key to give you a better memory in every way. After all, even memory tricks take a lot of work. You have to practice them. If you don't, you might forget them, too! The key to good memory is practice. Concentrate on what you want to learn. Do this several times and you won't forget. Now that's worth remembering.



Don't Forget!

Here's a trick that memory experts think can improve your memory. This is a system that should work for any list of items you want to remember. Say, for example, you are studying for a history test. You want to remember the names of the first 10 presidents of the United States.

The Memory System

First, you're going to do something that seems to have no connection with what you're trying to memorize. Form a mental picture of a place that's very familiar to you. Your room would be a good choice. Think about exactly how the room looks.

Now you're going to form an association between each president and each particular part of your room. Create a picture in your mind that is vivid and striking. That makes it easier to remember.

Start with George Washington. See him sitting at your desk, signing important papers. Next comes John Adams. Picture him pulling a book out of your book-

case. It's a book about germs called "Adam Had 'Em."

Go on around the room. For each item, create a picture that pairs it up with a president. Remember, the more unusual the picture you create, the easier you'll remember it. If you like, make your mental pictures silly or funny. Then think about each item for five or 10 seconds.

After you have finished, test yourself. Go on an imaginary walk around your room. See which president is sitting in each place. You should remember each one easily.

Why It Works

This is one of the world's oldest systems for improving memory. It is called the *system of places*. The system relies on something you already know to help you remember something that is less familiar. It creates clear mental images that are easy to remember. These images keep other memories from interfering with the one you want to recall.

The Bloodhound Gang



The Case of the Electronic Burglar

Part Two

by Bill McCay

In last month's episode, we learned that someone was spying on the Bloodhound Gang. The spy stole a code-breaking program from the Gang's computer and sold it to the Foxx Detective Agency. Mr. Foxx admitted buying the information, but he didn't know it was stolen . . . or who the spy was.

Who could the spy be? There was a repairman in the office, working on the telephone, but he never touched the computer. Janey, a computer-whiz friend of Zack's, was in the office—and she bet Zack that she could get at the Gang's computer. Zack himself had been working with the computer . . . and the next day, he came in with a brand-new, expensive bicycle! He got very angry when he realized that he was a suspect . . . but then Janey admitted that she had indeed tampered with the computer!

The Bloodhound Gang stared at Janey. "I'm not trying to get away with anything," she said. "I'm winning my bet with Zack. He bet me a free lunch that I couldn't get at your computer."

"But what about the decoding program you stole?"

Vikki said.

Janey frowned. "What are you talking about?"

"We're talking about your bet to get at our computer . . . and what you took out of it."

"I didn't take anything out of your computer. I put something in." Janey went to the computer's keyboard. "Zack and I put all kinds of instructions into the computer yesterday. But the next time he wanted to see that new stuff . . ." she typed LIST ALL NEW. "Instead of getting that information, he'd get this." The computer hummed and the screen lit up. There was no information on it, just the words YOU OWE JANEY A FREE LUNCH!

"That's *all* you did to our computer?" Zack asked.

"That's it. I won our bet." Janey was puzzled.

"Now what's all this stuff about stealing programs?"

"Come on," Ricardo said. "We'll explain it all over lunch."

"A free hamburger?" Janey asked.

Vikki laughed. "Why not?" They started walking to the door. "Aren't you coming, Zack?" ➔

Zack was at the computer. "Let me see what Janey did here. I'll catch up with you."

Everybody was already eating when Zack came in. "So somebody's stealing things from your computer, and you can't even find them again," Janey said around a mouthful of hamburger. "Nasty. But we didn't do anything to cause that. Zack and I were working on a project for the computer club."

"Yeah," Zack said. "All these lines of instructions for the computer. And hidden among those instructions were a few extra lines. That's what made those extra words pop up on the screen."

"Just a line here and there," Janey laughed. "But add them up, and they make the computer do something new and exciting!"

"Could the spy have gotten our code-breaking program that way?" Vikki asked.

"We're the only ones who work on that computer," Ricardo pointed out.

"And . . . and I'm the one who does most of the programming." Zack looked at his hamburger. "I'm not hungry anymore. Let's go back to the office."

Another Computer Crime

When they got back, the first thing they saw was a message on the computer screen. PLEASE CALL ME IMMEDIATELY. Mr. B.

Vikki ran to the phone. A moment later, she was talking with Mr. Bloodhound. "Yes, I see . . . WHAT?" She looked at the rest of the Gang. "Mr. Bloodhound needed some information from the file on the Purple Parrot Case. He called and got the information from our computer. He called later to get more information, and the file had its password changed!" She spoke into the phone again. "Something very weird is going on here. Could I call you back after we check it out?"

She hung up the phone and turned to the people in the room. "Did anyone work with that file?"

"No one did anything with the computer," said Ricardo, "except Zack, when we left for lunch . . ."

"I'm sick of this!" Zack said. "I didn't do it, do you hear me? I DIDN'T DO IT!" He was shaking.

"I can't believe Zack is a spy," Vikki said.

"You're right," said Ricardo. "I just wish we could show there was some other way to get at our computer."

"How about by telephone?" Janey asked.

"What do you mean?" asked Ricardo.

"I've heard of one way to steal from a computer. It

has to be hooked up to a phone—the way yours is. At night, you use a computer to call up the computer you want to steal from. Information is usually protected with passwords. So your computer is programmed with all the passwords you can think of. It keeps hitting the other computer with these passwords. If it keeps working long enough, it could unlock some information."

"That might work at night," said Vikki. "But this last theft didn't happen at night. We left the computer alone for just a few minutes."

Vikki frowned at the computer. "Have you noticed something? Nothing that Janey or Zack put into the computer got stolen. Only things that Mr. Bloodhound sent in over the phone line."

"Are you blaming us again?" Zack asked.

"We don't have to put up with this." Janey grabbed a pencil and some paper. She quickly scribbled something. "Let's go, Zack." The paper in her hand said FOLLOW US.

An Important Discovery

"Wait!" Vikki and Ricardo said, following the two out the door. As soon as the door was shut, Janey stopped. "I had to get you out of the office," she said. "I think there's a tap on your phone."

"Vikki gave me the idea when she mentioned the things that were stolen—only information coming in on the phone line. If there was a tap on the line, it would be easy to get the passwords for the information that went over that line."

Ricardo snapped his fingers. "That telephone man who was in here yesterday."

"Anybody have a screwdriver?" Vikki asked. Quietly, she went back into the office. She was back in the hall in a moment. "I opened the box where the phone wires come out of the wall. There's a little electronic gizmo clamped to the lines."

"A tap!" Zack said.

Ricardo nodded. "That guy must have disconnected our phone, so we'd think it was broken. That's why the phone was dead when you picked it right up. He hadn't had the time to reconnect it. Boy, was he sure of himself!"

Vikki headed down the hall to the pay phone. "I know our next step." She dialed a number. "Hello, Mr. Burke? This is Victoria Allen. I worked with you and Mr. Bloodhound on the Green Beard Case. We need some help. Could you find out if any repairmen were sent to our office?"

She leaned out of the phone booth. "Mr. Burke works for the phone company." Then she was talking into the phone again. "Nobody was sent? So our repairman was a phony."

"How will we catch him then?" Zack asked.

"I've got an idea. Mr. Burke, you helped Mr. Bloodhound by tracing a call. If we set a trap for these computer thieves, could you trace their call?" She listened for a moment. "Fine. I'll set everything up and call you again."

"I've always wondered how they trace phone calls," Janey said.

"The phone company uses special equipment at the switching offices that connect calls," Vikki said. "The only problem is, we need to keep them on the line for as much as half an hour."

"That may not be a problem," Janey said. "Computers don't work as fast over phone lines. They have to slow down the speed at which they transmit information." She rubbed her hands together. "I can slow down that speed even more. So all we need is a file in the computer with loads of information."

"Why not use the new stuff we were programming yesterday?" Zack asked.

"Fine," Vikki said. "I'll call Mr. Bloodhound and explain everything."

The Trap Is Set

Soon, everything was ready. The Gang and Janey stood around the phone booth, waiting. Finally, the phone rang.

Vikki answered. "Thanks, Mr. Burke." She looked very pleased as she hung up the phone. "Our plan worked. Mr. Bloodhound called into the computer and used the password. Now someone else is talking with our computer. And guess where the call is coming from? The Foxx Detective Agency!"

"Their office is close," Ricardo said. "If we hurry, we can get there while they're on our line!"

This time, Mr. Foxx didn't smile to see the Gang come into his office. "Well, this is a surprise," he said. "What can I do for you today?"

"You can tell us why you're calling up our computer and stealing stuff from it," Zack said.

"That's the silliest thing I ever heard in my life!" Foxx roared.

Ricardo wasn't listening to Foxx. He was following a humming noise. It came from behind a door. He pushed the door open. It was a computer, all right. And sitting in front of it was a familiar face . . .

the phony phone man.

"Uh-oh," he said, looking at the Gang.

"I hired this man to check how things are running through my computer," Foxx said.

"I'll tell you what he's running through," said Zack. "It's the program for the new Space-War game my friends in the computer club worked up."

Foxx began yelling at the telephone man. "Quick, erase the evidence!"

"Not so fast!" Mr. Burke stood in the doorway. Beside him was a police officer. "We don't like folks who use the phone lines to steal."

The next day, Vikki sat in the office, reading the newspaper. "DETECTIVE CAUGHT IN COMPUTER CRIME. Can you guys believe it? Mr. Foxx caught the phone man as a computer thief. Then he decided to use him to spy on Mr. Bloodhound's computer."

"Well, we caught him," Ricardo said. "But it shows us that we need to protect our computer better. It can't tell the good guys from the bad guys. It's just a machine, after all."

There was a hum, and the computer's screen lit up. WHAT'S SO BAD ABOUT THAT, HUMAN?

"What?" yelled Ricardo. Then he saw Zack sitting at the keyboard and laughing.

"Very funny," Ricardo said. "But just remember it took human brains to catch the Electronic Burglar!"

**Next month begins
a brand new
adventure, starring
the Bloodhound
Gang!**



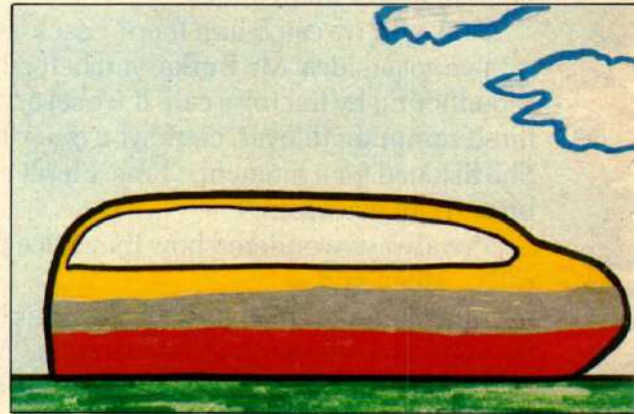
MAIL

Future Trains

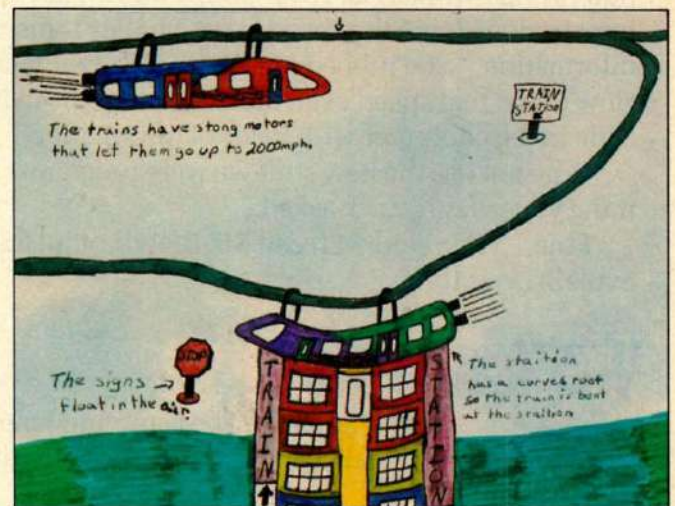
Thanks for sending in all those great future trains. Here are some of our favorites:



Cynthia Economos, Brooklyn, NY. Moon rays control the Night-Skater. It goes fastest during a full moon.



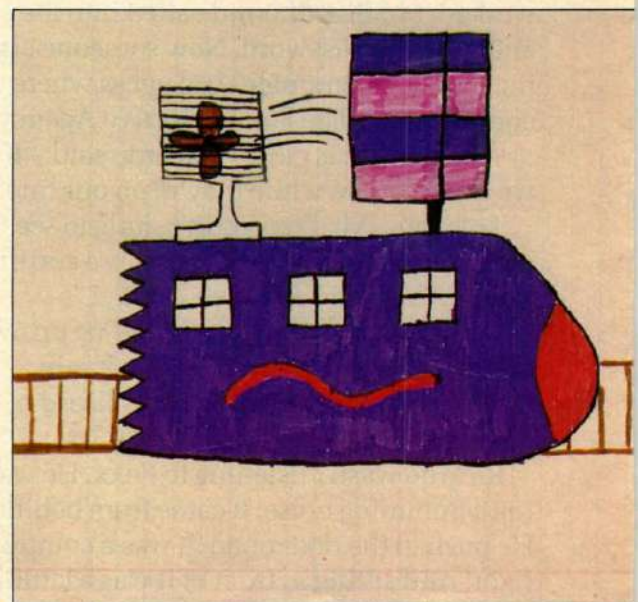
Todd Dorgwardt, Valders, WI.
This stream-lined train runs on diesel fuel.



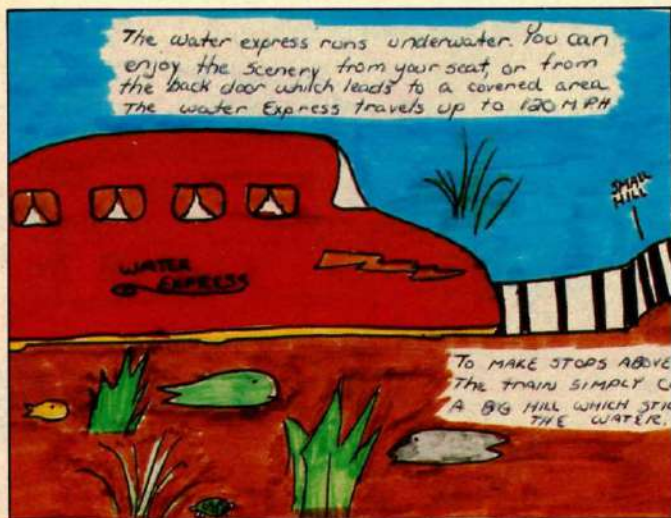
Deborah Owens, Everton, AR. These trains hang off a thin rail. They are small so they can go fast.



Jonny Dietrich, Catonsville, MD.
The Zoom Machine is powered by rockets.



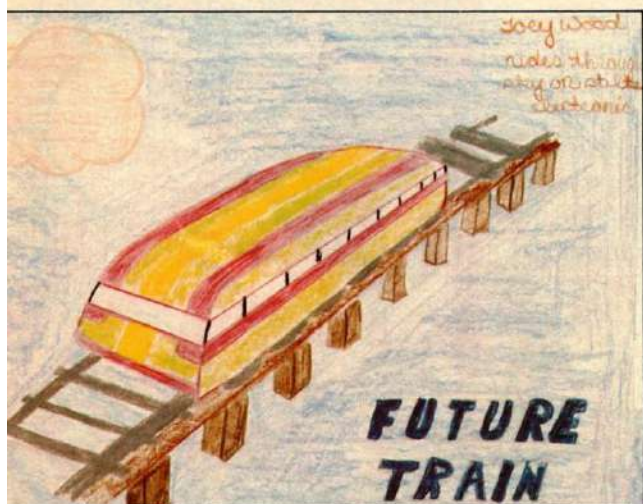
Chaya Moskowitz, Highland Park, NJ.
An electric fan powers this future train.



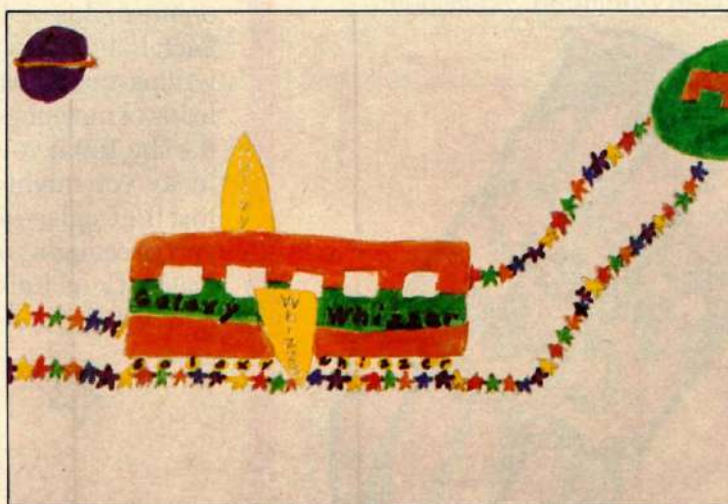
Jennifer Kadlitz, Warren, MI. In the Water Express, enjoy scenery from your seat or the back door.



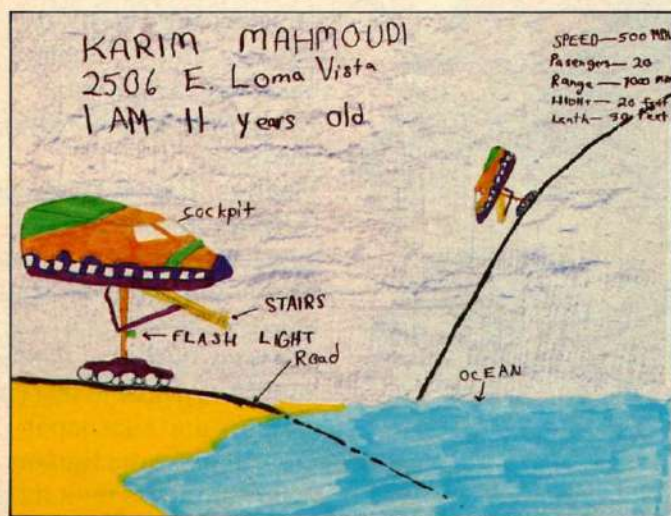
Regina Nutom, Homosassa, FL. One day you might see this solar-powered train zooming through the sky.



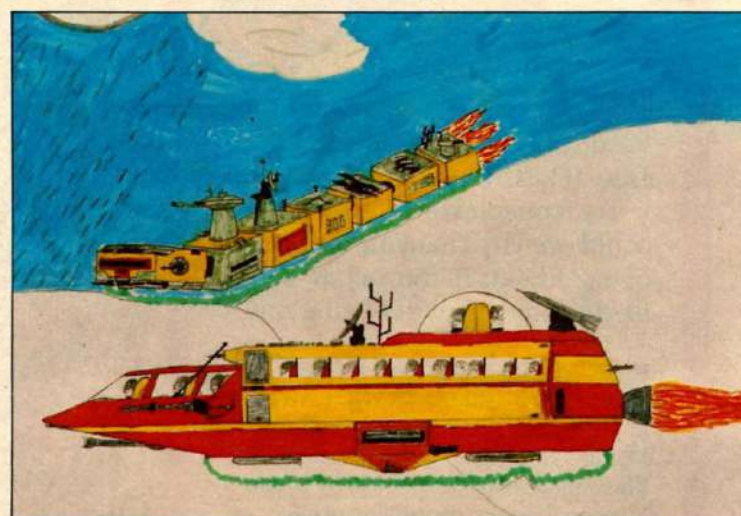
Joel Wood, Cincinnati, OH. In this electric train you'll ride high in the sky on stilts.



Krista Modracek, Cedar Rapids, IA. The Galaxy Whizzer runs on star tracks and travels in space.



Karim El-Mahmoudi, Victoria, TX. Big enough to hold 20 passengers, it can travel 500 m.p.h.



Glen Grasier, Schenectady, NY. Riding on a cushion of air, this train runs on atomic power.

Reviews &

Want more information on some of the things in this CONTACT? Or just something to do and see for fun? Keep reading!

Fake Cola

In *Any Questions?* we told you where root beer flavor comes from. How about one of your other favorites, cola? The recipes for most colas are a secret. But there's a concoction you can mix that tastes pretty similar. Here's what to do:

In a glass, mix 1 tablespoon sugar, 1 teaspoon vanilla extract, $\frac{1}{8}$ teaspoon cinnamon, $\frac{1}{2}$ teaspoon

bottled lime juice,
 $\frac{1}{2}$ cup club soda. Add ice.
Does it taste like cola?

Try it out on your friends. You could even try changing the amount of ingredients in the recipe. You might come up with a better one!

Fake Cola experiment from MORE SCIENCE EXPERIMENTS YOU CAN EAT by Vicki Cobb, illustrated by Giulio Maestro. Copyright © 1979 by Vicki Cobb. Illustrations copyright © 1979 by Giulio Maestro. Used by permission of J. B. Lippincott.

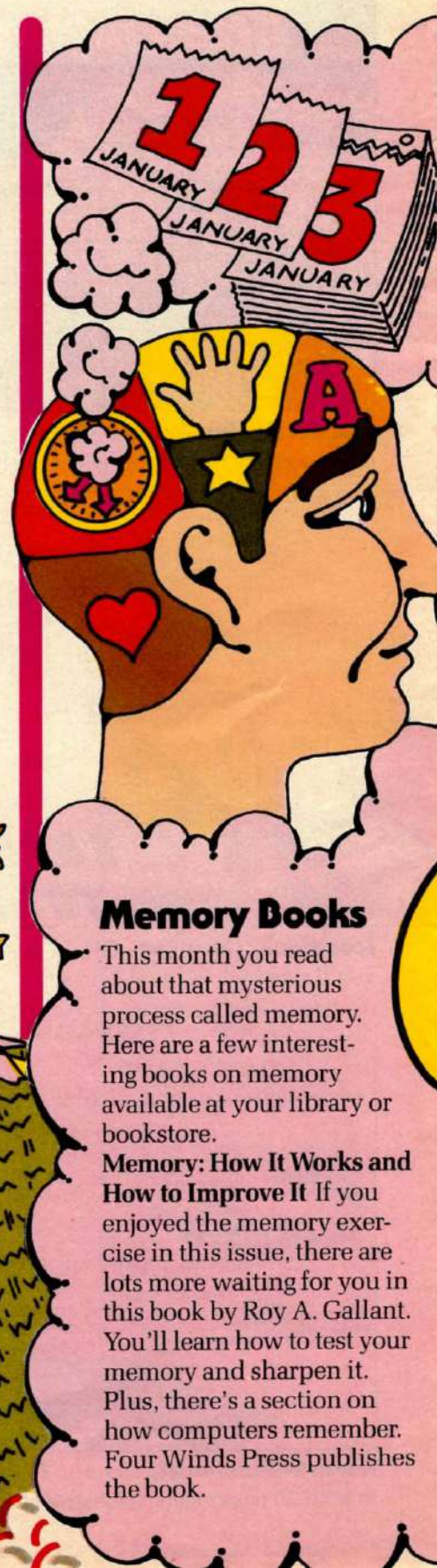
Skysight!

Attention sky watchers. The Lyrid meteor shower will arrive on the nights of April 21 and 22. Each hour, about 15 shooting stars will pass overhead. You won't see loads of meteors streaking through the sky. But if you're patient and lucky, you might see one or two. Just find a place away from house and street lights and settle back to watch. Good luck!

Memory Books

This month you read about that mysterious process called memory. Here are a few interesting books on memory available at your library or bookstore.

Memory: How It Works and How to Improve It If you enjoyed the memory exercise in this issue, there are lots more waiting for you in this book by Roy A. Gallant. You'll learn how to test your memory and sharpen it. Plus, there's a section on how computers remember. Four Winds Press publishes the book.



Previews

Brain Power This book, by Gail Kay Haines, doesn't just talk about memory. It explains how the mind works. You'll even read about experiments done with the human brain. Some are pretty strange! *Brain Power* is published by Franklin Watts.

The Brains of Animals and Man Bet you've never heard of memory pills. But there are drugs that scientists say can help people to remember. This is just one of the interesting things you can read about in this book, written by Russell Freedman and James E. Morriss. It's published by Holiday House.

3-2-1 Contest

On page 24 you read about how people remember things. Now we want you to dig back into your own memories. What is the very first thing that you can remember? Tell us about it. The first ten early memories we pick will be printed in **CONTACT** and the writers will get T-shirts. Send your first memory, name, address and T-shirt size to:

3-2-1 Contest
First Memory
P.O. Box 599
Ridgefield, NJ 07657

Garden Goodies

You might want to start your own garden after solving *Garden Scramble* on page 16. But first, you have to decide what to plant.

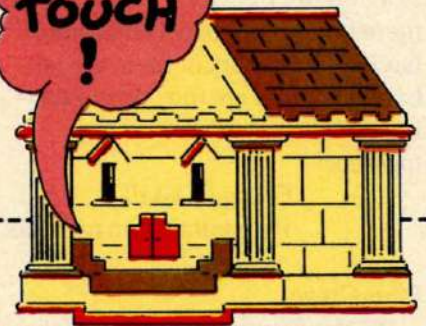
Here's a chart that might help. It lists fruits and vegetables, and the vitamins and minerals they contain.

Fruit or Veg.	Vit. or Mineral
Beans	Iron
Cantaloupes	Vit. C
Carrots	Vit. A
Green Peppers	Vit. C
Lettuce	Vit. E, Iron
Lima Beans	Vit. B
Peas	Vit. B, Iron
Pumpkins	Vit. A
Red Peppers	Vit. A
Spinach	Vits. A, E, Iron
Strawberries	Vit. C
Tomatoes	Vits. A, C
Watermelon	Vit. A

What It Does

Vit. A —good for eyes
 Vit. B. —good for skin, eyes, hair, nerves; helps body make blood
 Vit. C —helps heal wounds; fights infection; good for gums
 Vit. E —helps keep cell membranes healthy
 Iron —helps blood carry oxygen

PLEASE TOUCH!



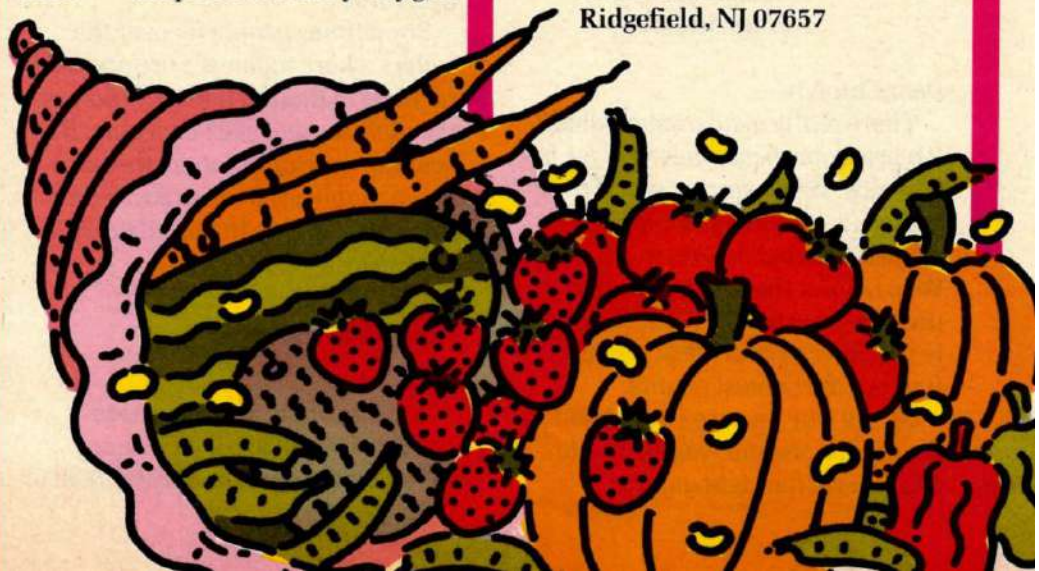
Please Touch Museum

This review was sent in by Peggy Frame, Midlothian, VA.

The Science Museum of Richmond, Virginia, is the best place. It has crystals you grow, mirrors and everything. You can touch anything and it only costs 25¢ for kids and 50¢ for adults. You can make things and take them home, like a design with a pendulum for 10¢. You can make a cartoon, too! You can see feeding fish. If you ever get a chance GO! It's fun.

Been to a science museum? Write us a review! If we use it you'll get a T-shirt. Send your review, name, address and T-shirt size to:

Museum Review
P.O. Box 599
Ridgefield, NJ 07657



Oops!

Dear Contact,

I noticed something amazing in last September's issue. It was in the story on fire fighters. On page seven, there is a picture of seven firemen having dinner. Six of them are left-handed! What are the odds of having that many lefties working together?

Gregg J. Oakill
Pottsville, Pennsylvania

Dear Gregg,

We don't know the odds, but we do know how such a thing could happen. You didn't realize it, but we goofed and you caught us.

Stand in front of a mirror and raise your right hand. Notice that the Gregg in the mirror has his left hand raised!

When we printed the photo in the magazine, it appeared backward by mistake. You are looking at the mirror image of the real picture. So instead of six righties and one lefty, you see just the opposite. We will try to be more careful next time. No sense letting things get out of hand!

The Mystery Island Mystery

Dear 3-2-1 Contact,

In last February's magazine, you had a mystery island contest. But in the March magazine there weren't any winners posted. Why?

Carolyn Alschuler
Aurora, Illinois

Dear Carolyn,

There really is no mystery at all! We print our magazines very far in advance. When you get your February issue, March has already been printed. For that matter, so has April. We can't put the contest winners in until we have picked them. So usually, you have to wait a few issues to find out the contest results.

By the way, in case you missed it, the mystery island was Bermuda. Did you get the right answer?

How Many Manatees?

Dear 3-2-1 Contact,

How do scientists know that there are only 1,000 manatees left in the world?

Jeff Gilliam
Roanoke, Texas

Dear Jeff,

Often, stories about rare animals will report how many are left in the world. But most animals don't stick around for a head count. So usually these numbers are expert guesses on how many are left.

In the case of manatees, scientists know where to look. These marine



mammals spend the winter in the warm waters around Florida. So counting them is as easy as one, two, three.

Sometimes people fly over the waters where manatees are and take pictures of them. Then they blow up the pictures and start counting. By keeping careful watch on the number of manatees in an area, scientists can estimate the number left in the world.

Tongue Twister

Dear 3-2-1 Contact,

I can turn my tongue upside-down, without my hands or anything. It looks a little ugly with all of

the veins sticking out. I can also roll it underneath and make weird designs. I can even touch it to my nose and chin. I thought this might make a good article.

Deanna Csomo,
Dyer, Indiana

Dear Deanna,

It sounds like you're ready to star on *That's Incredible!* Actually we once did a story on the tongue which included the things you can do. In the story we explained that, because of heredity, certain people can do some amazing tongue twisting. You're one of those people!

Rhyme Time

Dear 3-2-1 Contact,

I have written a little jingle about your magazine:

Contact thank you, you're so great.
You're interesting without debate.
Your mail, reviews and Factoids, too,
And all the super things you do.
Once more I thank you and now I'll say

I wish I got one every day!

Louisa Wimberger
Ramsey, New Jersey

Dear Louisa,

Your letter truly hit the spot. We really liked your poem a lot. So thanks for writing us, Louisa. We hope this poem will also please yah!

We Want Mail!

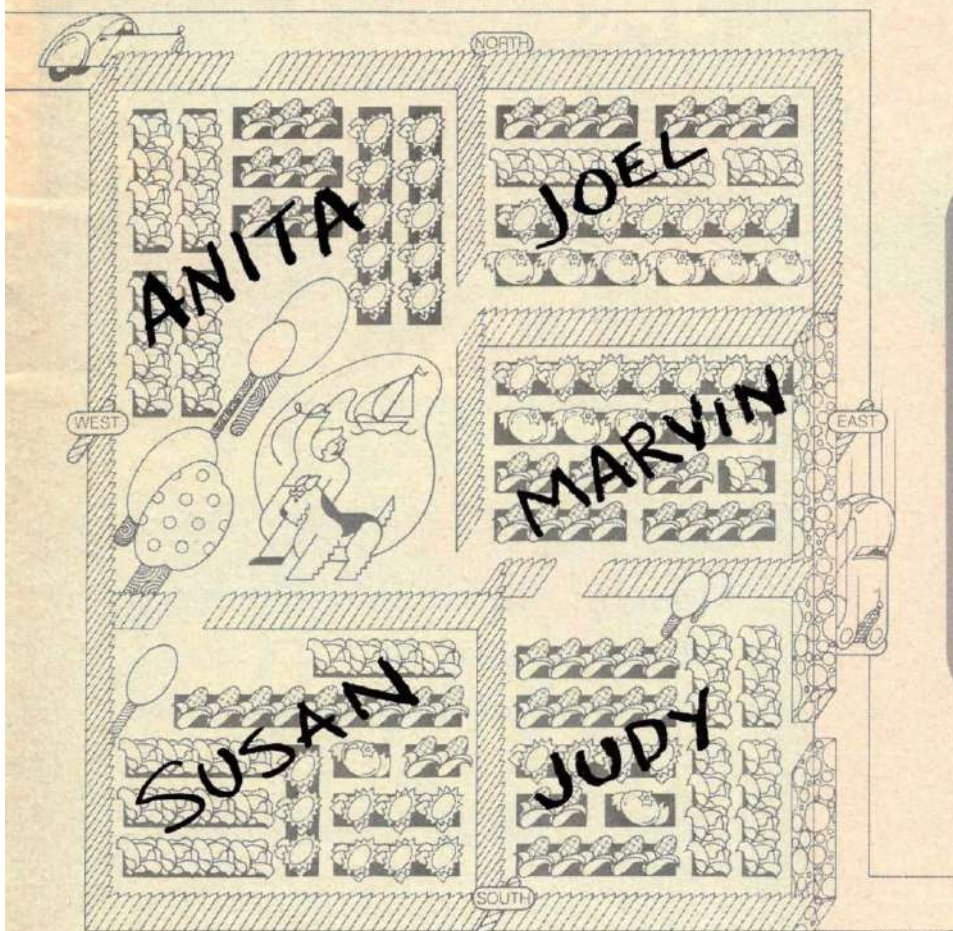
Dear Readers,

We really love hearing from you. The questions, ideas and complaints we get help us make CONTACT a better magazine. So why not drop us a line? We can't answer every single letter, but we do read them all. Send your mail to:

3-2-1 CONTACT Letters
P.O. Box 599
Ridgefield, NJ 07657

Did It!

Garden Scramble (page 16)



Oops!

The high-speed maglev train pictured in the November, 1982, *Timeline* and being tested in Japan is built by the Japanese National Railway.

Credits

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Next Month!

Here's a sample of what you'll find in the next issue of 3-2-1 CONTACT:

It's Chow Time!

Find out what zoo animals eat and take a zoo food quiz.

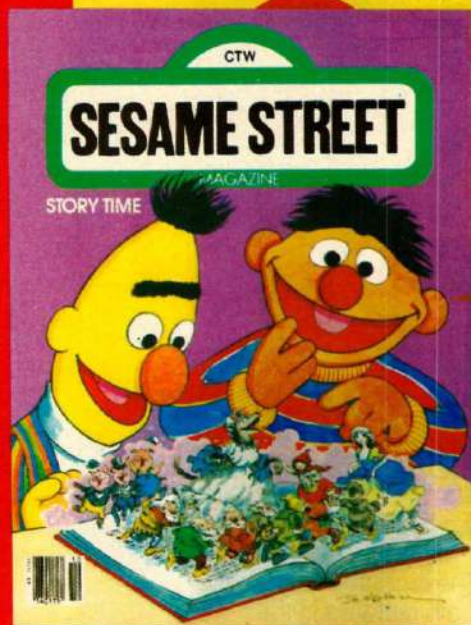
Future Homes

See what kind of house you might live in some day.

Bloodhound Gang

Vikki, Ricardo and Zack are on a new adventure—at a lighthouse.

Plus Factoids, a Poster, Letters and Much More!



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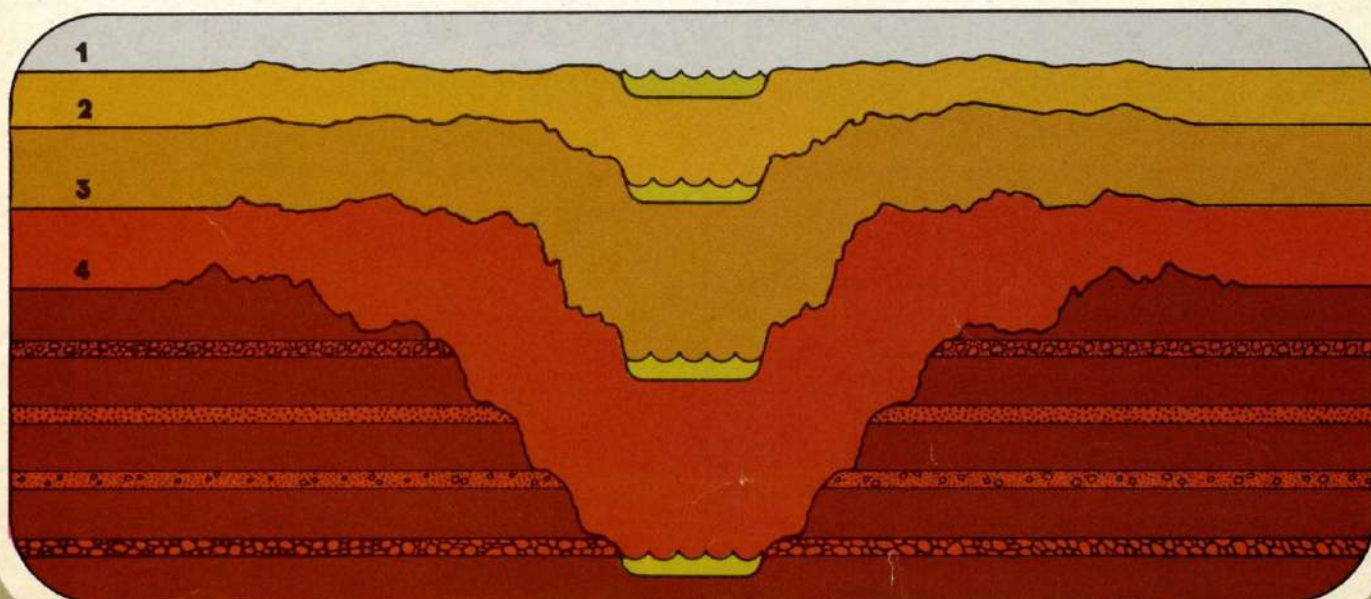
Earthfacts: Canyons by Nancy Arnott

Each month CONTACT will bring you another Earth Works. Save these pages in a notebook. Soon you will have your own guide to the wonders of the planet Earth.

EarthWorks

- A canyon is a deep valley with steep, rocky sides. Most canyons are carved into rock by the water of swiftly-flowing rivers.
- A river cuts a deep hole in the earth by wearing away the rock and soil under it. But this doesn't happen quickly. It took the Colorado River 10 million years to make the Grand Canyon in Arizona.
- Not many people live in canyons. But the Havasupai Indians have lived in the Grand Canyon for hundreds of years. A few hundred of them are there today. They grow food on small pieces of land 3,000 feet (914 m) below the rim of the canyon.
- The Grand Canyon's rocks have helped uncover a surprising fact about the desert around it. It was once underwater! Scientists have found fossils of ancient sea creatures in the canyon's lower layers. That tells them that half a billion years ago, the area was covered by a shallow sea.
- The Grand Canyon is eight miles (13 km) long and one mile (1.6 km) deep. But there are deeper canyons. Hell's Canyon, between Idaho and Oregon, was carved by the Snake River. It's almost one and a half miles (2.4 km) deep—the world's deepest canyon.
- There are many kinds of canyons all over the world. Some, like Greece's Vikos Canyon, are wide and bright, with cliffs of white limestone. Others are dark and deep. Vietnam's Laichau Canyon is so deep and narrow that little light gets into it. At the bottom it is often dark as night.
- The steep walls of Arizona's Canyon de Chelly hold the ruins of stone apartment houses. They were built by Pueblo Indians almost 1,000 years ago.
- In Utah's Bryce Canyon, the rocks have been eroded by wind and water into strange shapes that look like castles, towers and human figures. The canyon cliffs are brilliant shades of red, orange, yellow, white and purple.
- Canyons are often remote places that are hard to get in and out of. That's why they were often used in the past as hideouts for outlaws. Butch Cassidy hid out in Flaming Gorge, a canyon in Wyoming.

Below: 1. A canyon may start with a river flowing over flat land. **2.** Rain and wind wear down slopes around the river. **3.** Chunks of rock break off forming steep cliffs. **4.** After millions of years erosion has moved the walls far apart and the river is deep in the canyon.





EarthWorks

Canyons

This is the Grand Canyon. No, not the Grand Canyon you're thinking of—the one in Arizona cut by the Colorado River. This is a smaller Grand Canyon. The Grand Canyon of the Yellowstone River in Wyoming. The Yellowstone has been carving this canyon for a long time, and it is still cutting deeper. Some kinds of rock are worn away quickly; others take longer to cut through. That has made the land under the river uneven. It causes the rapids and waterfalls in this canyon, and in many others.

For more on canyons, turn to page 39.

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